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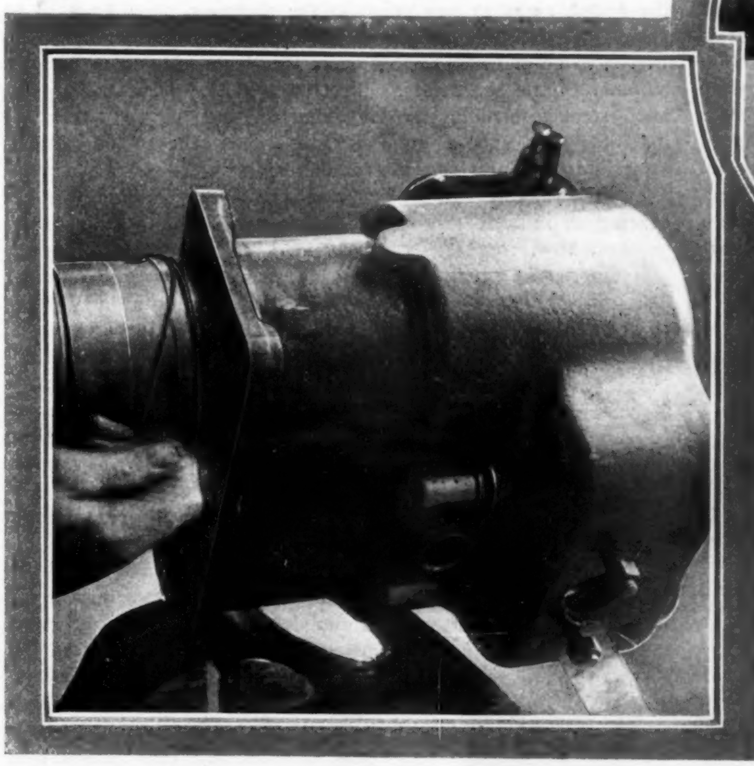
THE AUTOMOBILE

Noise Attended by Insecurity

The Antithesis of Speed with Security

Taking speed with security as a desired condition in automobiling, it is inferred that noise has its measure of insecurity, and it is pointed out in the course of this recount how some types of noises dominate the situation, leaving it to the owner of the car in a given case to apply his talents in the zone where each lick will do the most good. The illustrations are of such breadth of scope as to permit the repairman to conserve his energies, the idea being to spare excess cost in the making of repairs, without depriving the repairman of the enjoyment that he can purchase if he makes money by the fair route.



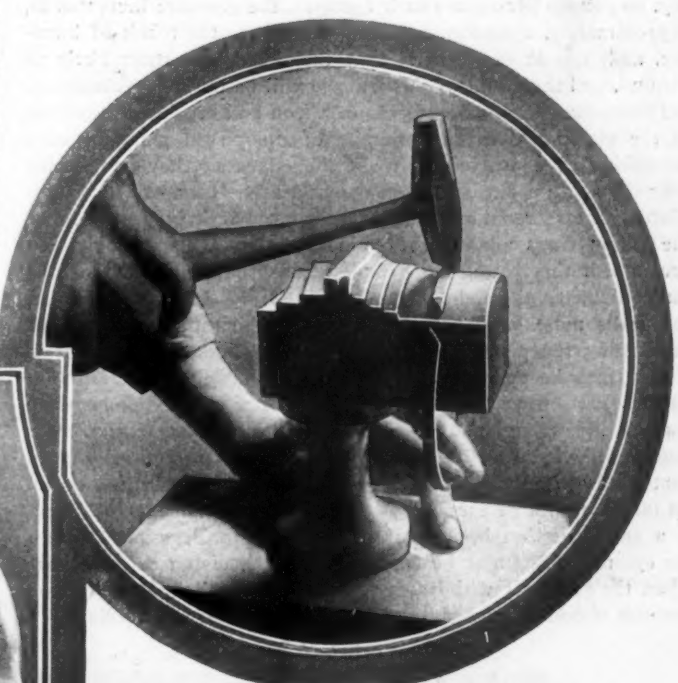


Fig. 1—Showing a twin cylinder clamped in a vice, with the cylinder walls smeared over with Prussian blue, and the workman putting the piston into place, using a string to compress the rings, in order to get an impression.

Fig. 2—Showing a piening fixture on a bench with a piston ring in place and the pien hammer resting on the ring, approximately in the position that it would hold after the workman strikes a piening blow.

EGGS rot if the old hen sits on them too long, and applying this thought to an automobile that is undergoing repair, there is a striking resemblance between the hen and the repairman. There is a great difference between hatching out a profit from an undertaking, and prolonging a repair job unduly. In the repair of a car, there are two points of view, and while the repairman is in duty bound to realize a profit, it is not too much to expect that he will permit the owner of the car to realize satisfaction.

From the owner's point of view, he should bring himself to a state of mind wherein he will fully understand that noise is attended by insecurity. The next step is to arrive at the conclusion that a very little of the sound that strikes the ear as strange is in the nature of a moan emanating from the nerve centers of the car, and unless its voice is heeded, and the work of repairing is undertaken promptly, the estimate of the cost of repairs will go up at an enormous rate.

There is a considerable difference between the work represented in the general overhauling of a worn-out automobile, and the repairs that will have to be made if the dictates of prudence take on the form of having the little noises investigated promptly, and after locating the reasons for their presence, make suitable adjustments and restore the automobile to its original sweet-running state of being. It is more than likely that the investigation of an automobile, after it begins to make noise, for the purpose of promptly applying the right remedy is attended by

severe troubles of diagnosis too frequently, and that half of the cost may frequently be charged to a wrong estimate of the nature of the disorder. As a broad proposition, if the motor refuses to run, fix the battery or substitute a new one, and the motor will partake of its old joyousness, or if the ignition is all right, and the motor persists in lagging, tighten up the joints in the intake manifold, and the carbureter will then be permitted to do the work for which it is intended. These are illustrations of the good work that can be done if the troubles as they creep in are accurately diagnosticated.

For the Best Result the Cylinders Are Ground and the Pistons with Rings Are Hand-Fitted

An infinitesimal leak of compression will have the effect of dissipating a large percentage of the fuel value of the mixture, owing to the fact that the leak is at the highest rate at the beginning of the power stroke. When the mixture is compressed, remembering that it is ignited and burned before the power stroke begins, in a well-designed motor, the compression pressure of, say, 60 pounds per square inch (gauge), the pressure increases to, approximately, 250 pounds per square inch as the result of burning, and it is at this critical time that leakage is most likely to abound, and the result of this leakage will be the most disastrous.

Piston rings are made of gray cast iron and are fitted into slots in the piston above the fastening of the piston pin, and it is something of a problem to make the edges of the piston rings bear tight on the faces of the slots, and after this work is accomplished, it still remains to produce an even outward pressure of the piston rings against the cylinder walls at every point. To accomplish this result the cylinders must be round and of the same diameter throughout the length of the stroke; moreover, the walls must be dead smooth, after which the operation of handfitting the pistons and rings to the cylinders, as shown in Fig. 1, may be undertaken with the reasonable expectation that success will crown the exacting effort of a man of some skill. As the illustration shows, the cylinder is clamped in a commodious device, and after the cylinder walls are given a thin coat of Prussian blue the piston, with rings in place, is shoved up into the bore of the cylinder and moved up and down, giving it a spiral motion besides in order that the Prussian blue on the cylinder walls may be transferred to the piston rings so that when the piston is withdrawn an inspection will tell whether or not the piston rings bear evenly all around. If a "holiday" (a

Fig. 3—Showing a sensitive drill with a chuck in the spindle holding a valve by the stem and a workman with a piece of emery cloth cleaning the stem of the valve as it rotates in unison with the spindle of the drill press

zone on a piston ring that does not coat over with Prussian blue, thus showing that it is not in good bearing) appears on any of the piston rings at any point in the diameter, they have to be removed from the piston and taken to a fixture, as shown in Fig. 2, to be piened. In this operation the workman uses a pien hammer of the character as illustrated, and by a few deftly applied strokes, striking the ring sharply, but lightly, at equadistant points spaced one-half inch apart, the piston ring is brought to the new required diameter and is re-shaped, according to the judgment of the workman, to give it the more perfect bearing as indicated by the impression taken in the manner as before stated.

It might take several repeated trials on the part of a man of little skill before the rings would assume the contour that is essential to tightness, and in view of the trouble that is always experienced in inserting pistons in cylinders, on account of the rings expanding, workmen have contrived simple means for compressing the rings during the operation of putting the pistons into the cylinders, and one of the best ways of doing this operation is shown in Fig. 2. A piece of string is wrapped around the piston ring, and sufficient pressure is induced to compress the ring into its slot, upon which the workman moves the piston into the cylinder, and after the ring enters the string is unwrapped and the operation is repeated with the next ring, and so on until all the rings are entered. In thus proceeding, the rings are saved from damage, and after a little practice the workman gathers sufficient skill to do this operation quickly without endangering the piston rings.

In manipulating the piston rings in the piening process, the novice is likely to break a few of them while he is getting experience, but a man of some judgment can learn how to pien rings in a little while, and it has been found, in the regu-

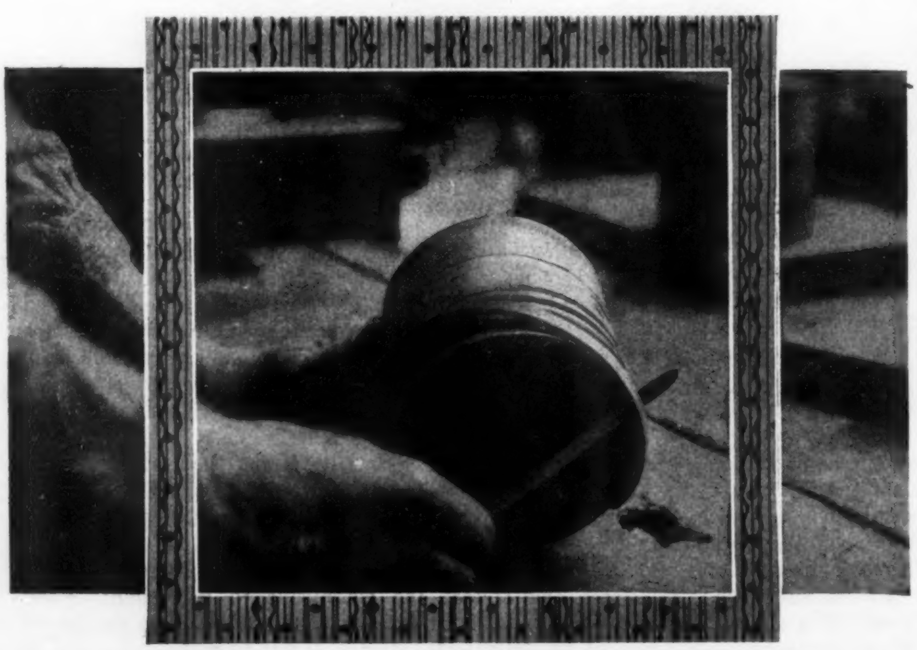


Fig. 4—Showing a piston with the ring being snapped off, the workman holding the piston with the left hand and a screw driver in the right hand, which he uses in the snapping of the ring

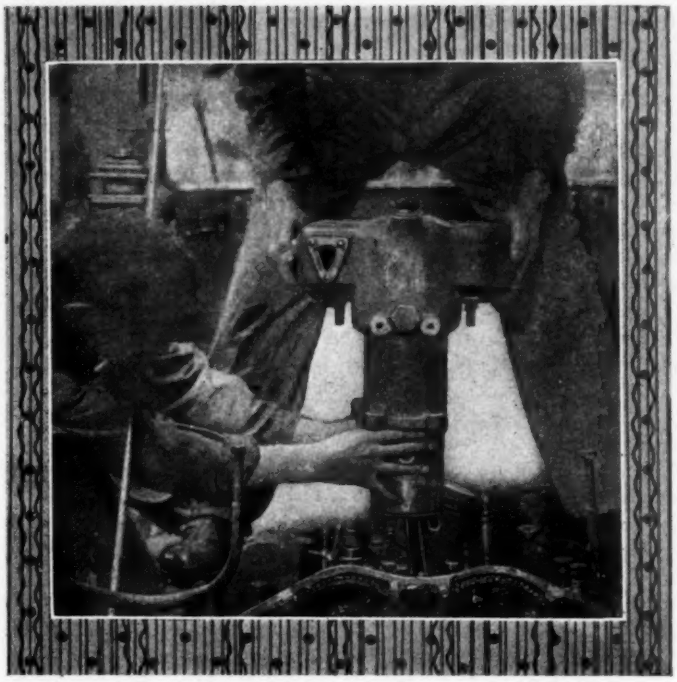


Fig. 5—Depicting the operation of lowering the cylinder down onto the piston with one workman holding the cylinder and the other guiding the piston into the bore of the same, taking care to protect the rings from damage

lar course of events, that a piened ring will retain its shape and exert its pressure for a long time in service, whereas a ring that has not been piened is likely to change its shape in a few hours after the motor is put to work, due to the fact that the temperature changes and alternating shocks, however light they may be, relieve the internal strains under which the "raw" rings labor, to the bias of service.

Good Work Is Frequently Undone by the Careless Removal of Rings from the Piston

The tendency on the part of the average relatively inexperienced workman is to fit piston rings too tight in their grooves. A properly fitted ring moves freely in all directions, and in the ordinary course if a ring resists perceptibly when it is moved about in the groove it should be taken out and the high spot, when found, should be scraped away. If there is much evidence of a poor fit the faces of the groove should be blued, and a trial of the ring against the blue faces should be made in order to get an imprint of the high spots so that they can be removed with care and precision.

Piston rings are far too frail to be turned over to the tender mercies of a blacksmith. The frailties of the rings disappear as soon as the pistons are inserted into the cylinders, owing to the support that is given the rings at every point, they being surrounded by walls on three sides of the piston, and the cylinder wall furnishes support to the fourth side. It is only necessary to consider the effect of good lubrication after the motor is assembled, so that the question of proper handling of the piston rings is the only one of moment. Fig. 4 shows a piston with the ring being removed. The workman holds the piston flat on the bench by his left hand and with a screwdriver in the right hand he pries the ring out of the groove and deftly snaps it off the piston. With the ring removed—if it is not in such bad shape as to require scraping—it may be dressed down in the manner as shown in Fig. 6, using a very fine crocus cloth laid on a flate plate, over which the ring is rubbed in partly a somewhat circular motion and light pressure. If the rings have been in service, and it is merely desired to remove traces of gum after the major portion has been scraped away, there will be no occasion for extending the operation until the crocus cloth bites the metal. If the rings are new, and there is slight evidence of a high spot to be removed in a given case, this treatment will satisfy the need.

Poppet Types of Valves Should Be Given the Fullest Measure of Attention and a Drill Press Will Serve as an Excellent Aid to the Operator

When a motor is taken apart and the valve springs are detached, thus permitting of the removal of the valves, besides inspecting the seat in the cylinder, it is desirable to examine the valves closely, cleaning them off so that the bright metal will appear to the eye and to note whether or not they are in sufficient fettle to permit of their further employment in service. It may be that the valve stems will be worn elliptical, which will be disclosed by using a micrometer to measure the stem at two or three points, circling around the diameter, and remembering that a leak of any moment around the valve stem on the intake side of a motor has the effect of bleeding excess air into the mixture, thus destroying its balance, or that a leak on the exhaust side around the valve stem permits of the escape of the exhaust products of combustion, thus delivering a disagreeable odor, perhaps accompanied by noise, it remains to consider whether or not it will be necessary to bush the guides for the valve stem, in which event the operator has two options in treating with the valve to get the stem back to round. If the stem is but slightly out of round it may be chucked in a drill press as shown in Fig. 3, and while the stem is rotating with the spindle of the drill, after the power is turned on, the operator may use various grades of emery and crocus cloth in the process of "eye dressing" the stem. But if the stem is considerably out of round, a speed lathe may be employed, centering the valve in the lathe, and taking a light cut with a diamond-pointed tool, the latter to be of carbon steel of the grade used in tools for chasing threads.

In addition to getting the stem back to round, the drill press

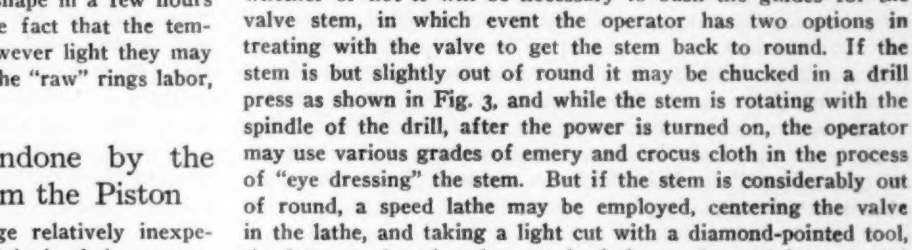


Fig. 6—Showing a piston ring being cleaned by rubbing it across the face of fine crocus cloth, the latter resting on a flat plate on the bench

Fig. 7—Showing a clamp holding the copper gasoline pipe to be expanded and an expanding tool placed in position ready to begin the expanding operation

operation, as shown in Fig. 3, serves extremely well in the cleaning of the valve to remove carbon incrustation or gum. If a piece of crocus cloth or emery paper is laid upon the platen with the rough side up, and the spindle of the drill press with the valve chucked in the manner as shown is lowered down, upon speeding the drill press the face of the mushroom of the valve will bear against the crocus cloth, or emery paper, and the rotary motion imparted by the spindle of the drill press to the valve, to which is added slight pressure on the part of the operator, will result in the quick removal of the carbon or other accumulations.

When the Cylinder Is Being Put Back on the Motor the Bungling Repairman Undoes All the Good Work That Is Lavished Upon the Piston Rings Up to That Time

As a conspicuous example of the difference between the methods of capable men and those of the other kind Fig. 5 is offered. It will be seen how two workmen co-operate in the placing of the cylinder on the top half of the crankcase of the motor. One workman holds the cylinder suspended in the vertical position above the motor and the second workman, in a stooping position, guides the piston into the bore of the cylinder, compressing the piston rings in the interim in order not to damage them in the process. The cylinder must be held suspended and steady until the man who is compressing the piston rings is ready to permit of the lowering of the cylinder, and the man who holds the cylinder must lower it at a slow and steady gait, making sure not to skew the cylinder and pinch the rings during the lowering operation.

Gaskets, When Improperly Fitted, Cause No End of Trouble

In the better class of motors, ground joints obtain wherever it is possible to resort to this practice, and copper-faced asbestos gaskets are employed in the remaining situations. In the operation of a motor if the intake manifold leaks around the flanges, owing to the presence of defective packing, or on account of poor clamping, the mixture will be so unbalanced that the proper operation of the motor will be seriously impeded, and in an extreme case the motor will fail to operate. It is not at all difficult to find motors in operation that fail to regulate properly, and in the majority of these cases the owners of the automobiles are decrying the quality of the carbureters in use in the face of the fact that the carbureter has nothing to do with the disorder complained of. The only possible way by which a carbureter can be made to serve its intended purpose is to bring all of the air that goes to the cylinders of a motor through the carbureter orifices, of which most carbureters have two, one being for the primary intake and the other for the auxiliary air. It will be seen that a leak at a packed joint of the intake manifold is a mischief maker of the first magnitude, and the best recommendation that can be made to an automobilist who is complaining of carbureter trouble is in the direction of representing to him that the packed joints at the flangings are crying for attention.

In quite a number of motors the flanges are faced off plain, and the flange faces on the motor cylinders which are designed to accommodate the manifold are also faced off plain. It is not uncommon to see a workman take a piece of coarse asbestos fabric, bite it off with a dull knife to a shape that looks something like the flange face, and in this raw state the packing is put into place, the manifold is lifted up and adjusted into position, the nuts are screwed onto the studs, and the workman, realizing that the trouble is out of sight, whistles a tuneless lay as he goes in search of further mischief. If the manifold is designed for plain packing a sheet of close-weave asbestos should be cut into squares that will cover the faces of the flanges and, with a pien hammer, the workman should work around the sharp edges of the flanging, delivering a series of well regulated blows, thus bruising the fabric, leaving the imprint of the flange, and, by

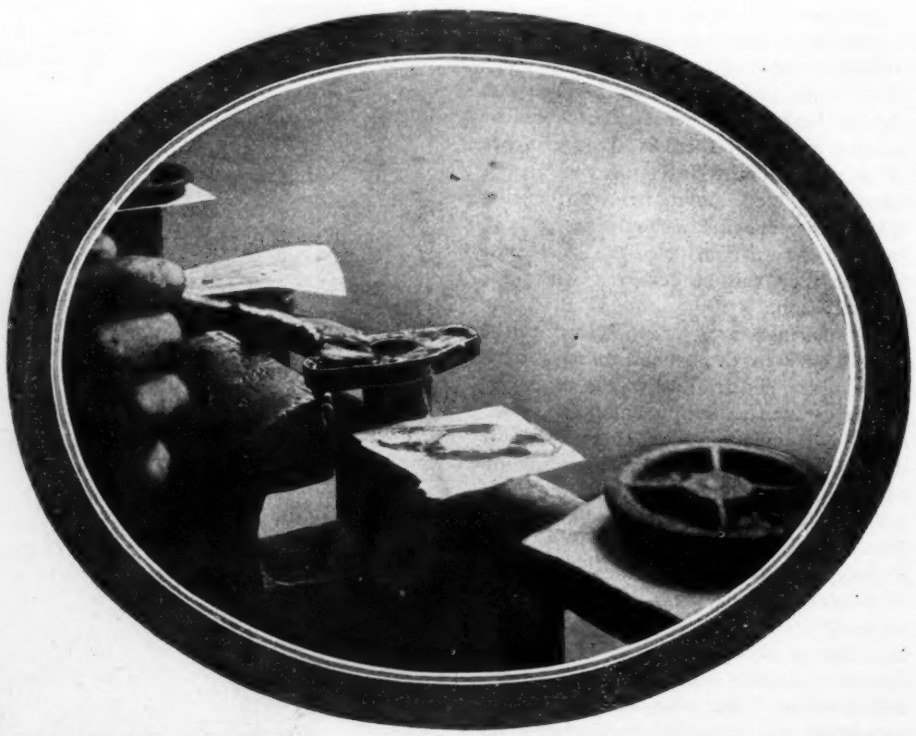


Fig. 8—Showing a manifold with the asbestos fabric which is used for packing in place, being held by cement, also showing how the impression of the packing is taken by hammering against the edges of the flange

this process, cut the packing to a neat size. When all the packing units are so made it remains to mix a cement to suitable consistency of the right ingredients for use in cementing the packing to the flange of the manifold, and when the manifold is being mounted into place on the cylinders it remains to apply cement to the flange faces of the cylinders for the purpose of making a tight joint. Fig. 8 shows a manifold and the cutting of the asbestos fabric in the manner as above described, and Fig. 9 shows how the fabric is removed by means of a rat-tail file, and in this example the cement was applied to the flange facings of the manifold, and the fabric was stuck on before the cutting process began.

Of the various cement compositions that are used in work of this character there is probably nothing that is so efficacious as a mixture composed of:

Yellow oxide of lead;

Glycerine (free from water);

Using these ingredients, the cement is mixed to the proper consistency and applied to the work in its fresh state.

It has been found in practice that this cement will not work if the glycerine is ladened with water, or if the yellow oxide of lead is impure.

This form of cement is heat and acid proof, and it has, in addition to cohesiveness, the homogeneous properties that are required in this class of work.

Fig. 10—A form of blunt nose expander used for expanding the ends of gasoline piping, showing the same in position, with the expanding operation partly completed

Repairing the Gasoline Piping System Is Given but Poor Attention More Often than Not

There are three important considerations in connection with the gasoline piping system, involving safety, economy and service. It is not safe to permit gasoline to leak at the joints of the piping, from the tank, or at the carbureter. It may be a little difficult to keep carbureters from dribbing gasoline, but the idea of having a lot of joints in the gasoline piping is intolerable, and of the joints that are not to be avoided, it remains to be said, they should be well made. The copper piping that is used in this service must be annealed after it comes from the warehouse in order to render it fit. This piping when new, in its unannealed state, is brittle and, in addition to giving trouble in working, it is unreliable in service. The annealing process is too simple to be neglected. All that has to be done is to pass the piping through the heat of a Bunsen burner at a slow rate, raising the heat to bring out the dull red color on the piping, allowing it to cool in still air.

The fittings as usually made require that the end of the pipe shall be dressed fair and expanded, and for this purpose a set of expanding tools, including a suitable clamp, are essential to good success. Fig. 7 shows the pipe in a clamp in the vise, and the expanding tool in the left hand of the workman, ready for the expanding operation. When the tool is inserted in the end of the pipe he strikes blows with a hammer and the shape of the tool is such that the end of the pipe is expanded sufficiently for the purpose. Fig. 10 shows a blunt nose expanding tool, which may be employed in connection with the one shown in Fig. 7.

For the photographs from which the illustrations in this article were reproduced we are indebted as follows: Figs. 1, 2, 3, and 4, the Pierce-Arrow Company; Fig. 5, the Alco Garage; Fig. 6, the Palmer & Singer Mfg. Company; Figs. 7, 8, 9 and 10, the Winton Company.

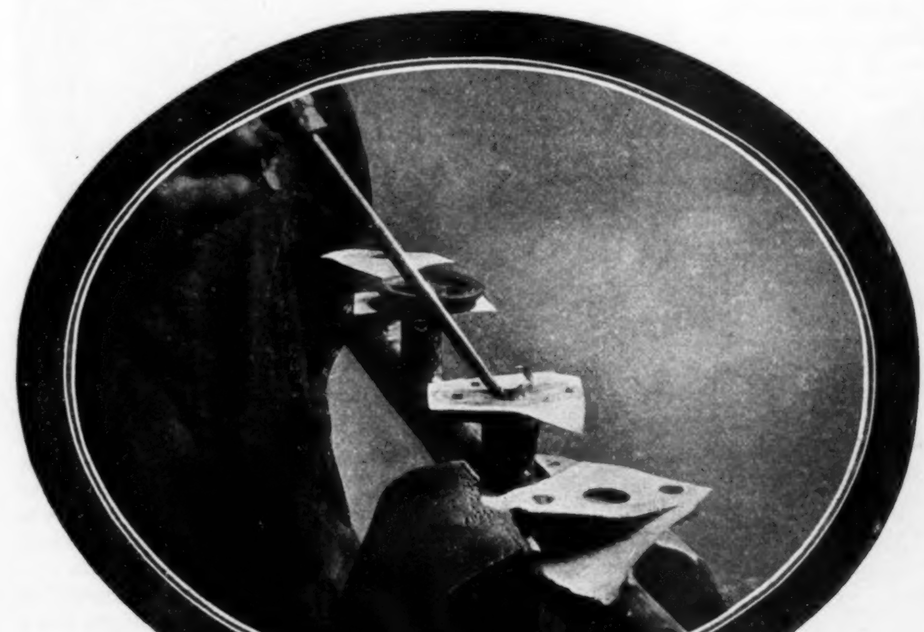


Fig. 9—The manifold with the packing cemented down after it is fashioned by the hammer, showing a workman with a rat-tail file removing the parts of the fabric that are not required. Care should be taken not to tear the packing

AUTOMOBILES IN WARFARE—Foreign armies are taking kindly to automobile forms of transportation. During the creative stage the men who had charge of this work, although they knew that horse-drawn vehicles were incapable of supporting armor-plate, did not have the sense to understand that automobiles are substantially in the same fix. The natural inference was that automobile trains for army work would fall short of the best requirements unless they could be made bomb-proof, although the men who established the standards made no attempt to state how they would fasten armor to horses and obtain result.

Bizarre Body Design

To meet the demand of an open body along the lines of the submarine type recently illustrated in THE AUTOMOBILE *a flush-sided body with ample protection has recently been placed on the market by a French firm of body-builders. Elimination of wind resistance has received careful study, as the illustration bears witness.*

THE submarine type of body recently placed on the market by the French firm of body builders, Aliu et Liotard, has become popular in France, and another type designed by the same firm along similar lines is here depicted. It is clear that wind resistance has been cut down to a minimum and the utmost protection is given to the occupants. The seat level has been placed particularly low so that the small wind shield is above the level of the passengers' heads.

The body has a decided one-piece effect, the entrance being through the door that can be seen in Fig. 4. The back rest of the left-side front seat folds to allow the passengers to obtain ingress to the rear seats. Pure air is provided by means of adjustable ventilators and the cowl has a glass window to assure a sufficiency of light on the dashboard fittings, such as the lubricator and speedometer. The extra protection from air currents will be noticed in the shape of a "bulwark" running round the entire upper ridge, and the shape of the windshield as seen in Fig. 3 is such as to cause the air that strikes it to be diverted over the heads of the passengers, due to the slight outward curve at the top. The glass shields are independent and can be opened, permitting a full flow of air on a hot day.

A good impression of the seating arrangements may be obtained by referring to Fig. 4. This in conjunction with Fig. 2 shows the method adopted to eliminate back suction, the bowl-shaped back being fitted with a locker for carrying tools and spares, leaving the running boards clean.

BRAKING BY MOTOR—For mountain touring it is recommended to arrange a special air intake on the induction tube between the carbureter and the cylinders, and to provide means for opening this intake when desired, so that the driver, when descending long inclines, may admit fresh air to the cylinders under full compression and get the brake effect thereof, rather than cutting off both gas and air, as is more commonly done.

Fig. 1—Three-quarter view of an original body along the submarine lines. The position of the driver will be noticed

Britons Boost Commercials

In order to instill into the drivers of commercial vehicles care and consideration for the property in their charge, the C. M. U. A. organizes an annual parade, for which money prizes are given—Royal Automobile Club defends members in legal proceedings and facilitates touring.

LONDON will see the fifth annual parade of motor vehicles on Whitmonday, June 5. These parades, which were originated by the Commercial Motor Users' Association, which has for its object the encouragement of drivers of tractors, wagons and vans, to which end money prizes and other awards are given to the participants in the parade. Practically the entire day is devoted to this form of divertisement, the parade beginning at eleven o'clock in the morning and ending about six in the evening. Three championship prizes of 7 pounds, 10 shillings and 5 pounds and 3 pounds, respectively, will be offered for the best results. One of the conditions of the entry in the competition is that the driver must have kept a weekly log from January 1, 1911, to March 1. Not alone will the championship prizes be given, but the drivers of the best vehicles participating in the parade of June 5 will receive first, second and third prizes.

The "R. A. C." have organized a free legal department for complimentary service in the matter of representing members and associates of the clubs in police courts. The plan, which has been in operation since September, 1910, is working splendidly. The majority of the cases have consisted of summonses for exceeding the speed limit on open stretches of road in instances where the member or associate has not been in the position to dispute the accuracy of the police timing. In such events the member or associate is invariably represented by an accredited barrister who is empowered to act in the absence of the personal attendance of the alleged offender.

Fig. 2—Three-quarter rear view of the original type of body fitted to a Gregoire chassis

The Local Government Board has officially notified the "R. A. C." to issue international travelers' passes on behalf of the board every six months. This pass has proved of inestimable value, all difficulties of travel being obviated thereby in connection with automobilists procuring licenses in various Continental European countries. Foreign Governments have awakened to the advisability of encouraging alien motorists and they are making special efforts to welcome them.

Selling Cars in Germany

American automobile makers cannot hope to establish profitable trade relations there through correspondence. French concerns, by establishing agencies, with the necessary repair shops and facilities for quick replacement of parts, have succeeded in building up a profitable business.

GERMAN automobile manufacturers are in the habit of soliciting trade through the medium of commercial travelers and also by catalog, the latter being made use of to a very great degree. The Germans, however, do not make signal use of unique methods of advertising, nor do they advertise through any channels generously. One French concern, which has formed a separate stock company under the German laws, maintains an independent organization in Germany. This concern imports automobiles and accessories from its own factory in France, and at the same time goes on selling independently, as per organization laws, keeping its German head office and stock room in Frankfort-on-the-Main. The company also has an extra shipping depot as a subagency in Germany, thus being in the position at all times to fill orders quickly. The house is also enabled by this system to keep in constant touch with its local agents in Germany. At the same time this method of close juxtaposition serves as a check on losses which might accrue in case of no agency of the French concern being located in Germany. The company also keeps up repair shops and stockrooms. American manufacturers have frequently been known to try to select an agent in Germany through correspondence. This method never has resulted satisfactorily. Appointment by personal interview is the only profitable policy. The commission paid to the agent or dealer usually runs from 10 to 15 per cent. It is necessary to supply the representative with accessories free, and in the case of tires the agent must have the authority to allow the prospective purchaser the privilege of trying the tire on his automobile.

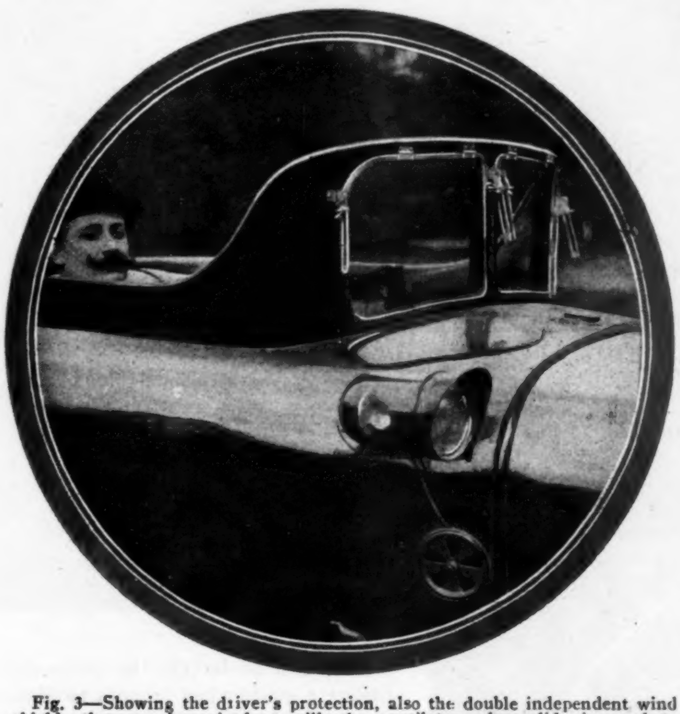


Fig. 3—Showing the driver's protection, also the double independent wind shields that can be raised at will, the ventilator, glass slide in cowl to illuminate the dash during the day and the filler for the oil tank or gasoline tank as the case may be

Fig. 4—General appearance of the new body as seen from above. The entrance can be seen, there being but one door. The passengers' seat in the front collapses to afford entrance to the rear seats

The Far West--Characteristic Scenery

Why It Is Not Necessary to Go Abroad

Presenting photo reproductions of mountain scenery as it obtains in the Far West. Telling of the possibilities for rest and recreation for the automobilist under conditions that will enable him to become acquainted with the characteristics of his own land. Indicating how unnecessary it is to go abroad for what is to be had better at home.

MOTORING in America is a subject that has yet to be taken up in earnest. Motoring abroad is being shunned. Why an American automobilist should go abroad on tours when he can have his fill at home is a moot question. From the accommodation point of view there are good hotels in this country where it is the aim to give value for the money, and it is scarcely necessary to point out that this is the land of good living from the hotel point of view.

Referring to scenery, all that remains is to show some of the scenic grandeur that the average automobilist turns his back on when he goes to Switzerland to look at the mountains. America has its quota of this daring handiwork of Nature. As for pure air-ozone, there is no monopoly; it is prevalent on every mountain side. If snow-capped peaks are desired they grow high up above the timber line on every touring peak. The Far West is their home.

Crossing the Great Divide brings one to the most rugged scenery in the world; long before the Divide is reached the happy tourist is introduced to the beauty that wild Nature provides for the tourist who is venturesome, and the farther west the trip is extended the more varied is the panorama. Of accommodations, while they are at times somewhat scattered, the fact remains that a properly organized tour, in the hands of a capable touring master, is scarcely to be discommoded. True, if a lone tourist unaccustomed to the wilds of Nature gets lost he must blame himself for his foolhardy attempt to accomplish the impossible. The way to undertake tours is to provide for the trip; take along the trappings that are necessary to safety and comfort and if possible get a man of experience to tell of the needs of the occasion.

Most of the trouble that has been experienced along this line was due to the lack of the tourists who, taking the experience that they gleaned by touring near home, utilized it for what it was worth under a far more difficult set of conditions. The man who goes gunning for bear in Wall street has very little ground for assuming that he will be a great success at gunning for bear in the woods of Maine, and if he can be persuaded to engage a guide when he goes to Maine to shoot it will be the better for his comfort. In touring through a wild country to take a guide along is the proper course, and if a party of tourists can be obtained it remains to be observed that the cost per tourist will be reduced and the undertaking can then be on a more enterprising basis. It is this type of undertaking that the Touring Club of America is making a good success of now.

In the Garden of the Gods, in Colorado, the Siamese Twins stand sentinel over a prospect as beautiful as it is inspiring

The Hanging Rock, in Clear Creek Cañon. The profile of the Indian deity, who the legend says once stood guard over the place, is easily distinguished

Colorado furnishes bits of scenery that few foreign countries can excel—the beautiful Ousel Falls is one of them

Touring in Western Canada

Simcoe, Gray and Bruce Counties in Owen Sound are the fortunate possessers of splendid roads. A certain cement quality in the gravel and stone makes the highways quite equal to macadamized roads. Although there are but six motor cars in Owen Sound owned by private individuals, and one automobile for public hire, scores of touring parties head for Georgian Bay Summer resorts during the season and a great many automobiles are to be seen. One touring party made the distance of 162 miles from Niagara Falls to Owen Sound within the space of seven

hours. They reported the roads as being in excellent condition, and as improving until they reach the bay. There are 200,000 inhabitants residing in the Owen Sound district, the towns including Markdale, Derham, Harriston, Hanover, Chesley, Southampton, Wiarton, Meadford and Collingwood. A big opening exists in that section of the country for passenger and freight automobile service, the towns now being wholly dependent upon teams to supply the local traffic. Owen Sound finds it impossible to take care of its trade without the aid of automobiles, for business men are chronically behind in their deliveries in spite of the fact that eighteen livery establishments are maintained there. The only months that the snow proves a serious impediment include from January to April. The people of the country are beginning to ask if it is not wiser to adopt motor cars for passenger and freight service than it is to depend upon the two lame railway lines which are now in commission.

Savannah Club Uses Blue Book

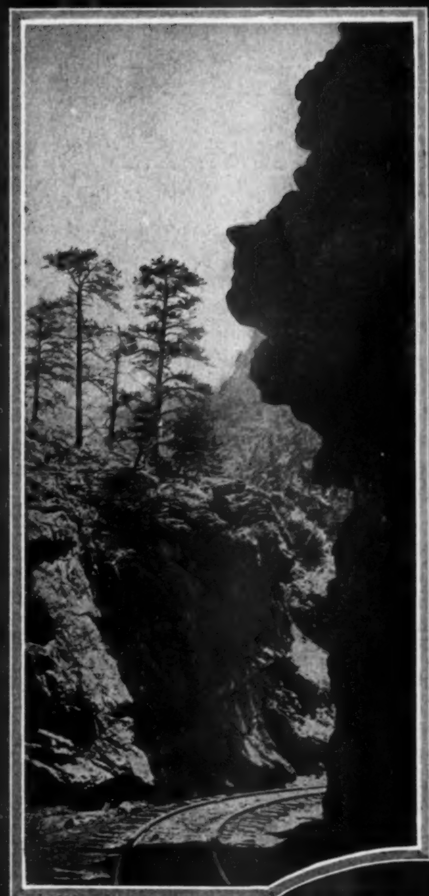
When the Savannah Automobile Club holds its interstate run next week the route that will be followed is one that is based upon the information furnished to the club by the *Blue Book*. This information is contained in Volume 3, which also includes touring directions covering at least 10,000 miles of new Southern highways as well as the regular New Jersey routings.

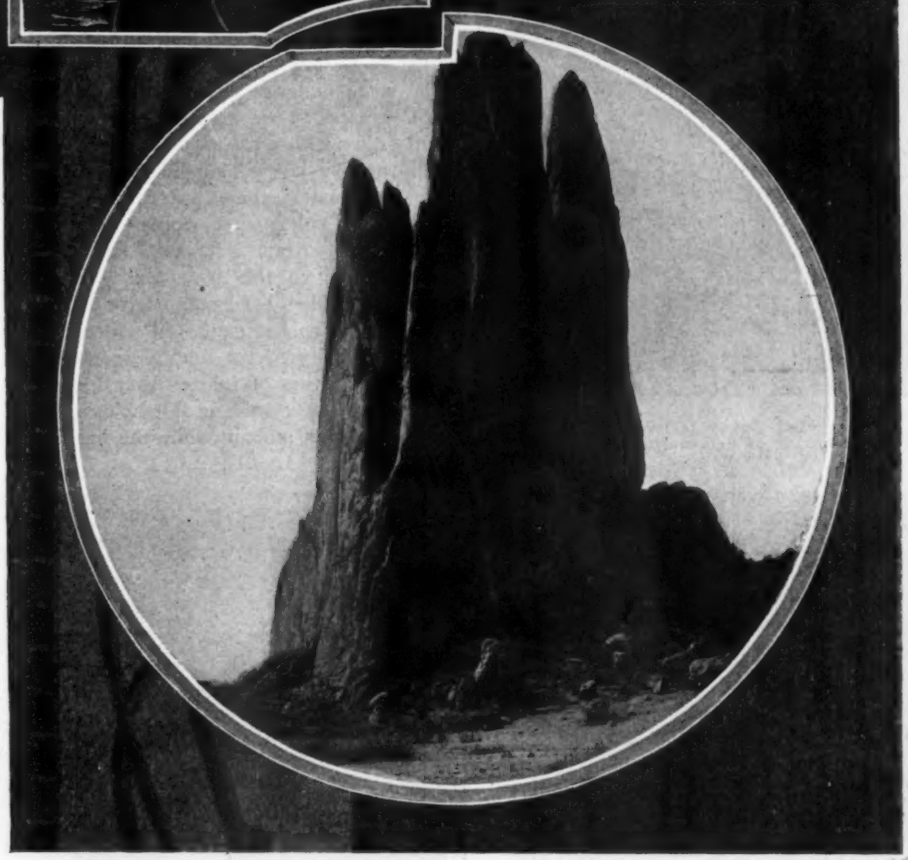
Volume 3 and 1, the latter dealing with New York roads, are ready for distribution and Volume 2, the New England book is about ready.

T. C. A. Busy Mapping Tours

The "Call of the Road" has been sounded more insistently this year than ever before since the automobile came into common use, and one straw that indicates the trend of this progress has been seen in the extra demands that have come to the Touring Club of America for information as to early Spring tours.

The roads of Massachusetts and New Jersey are reported to be in better condition than ever before, and the officials of the club are called upon to map out tours in both of the States named almost every day.





In the Grand Cañon of the Arkansas there is a constant succession of magnificent views—the Royal Gorge is one of the most charming

In Clear Creek Cañon a sharp curve throws out against the sky the clear profile of Mother Grundy in the living rock

One of the wonders of the Garden of the Gods is the Tower of Babel, a column of rock shooting many hundreds of feet skyward

Materials Used in Top Manufacture

Dealing with the Selection and the Care of Same

Any material used in top manufacture must be primarily waterproof and capable of becoming impregnated with moisture without stretching, and, secondly, be of suitable texture to withstand heat and dust without showing signs of early deterioration. The question of wear from friction is somewhat a matter of how the top is made, but largely one of proper folding.

NOW that the touring season is upon us it behooves the autoist who uses an open car to take the question of the car's covering seriously into consideration. Fine weather and disuse are the two important factors that must be held accountable for the bad condition of the top, apart from the mere question of the material employed. If the car has been laid up for the winter with the top folded, or perhaps a limousine body has been used while the touring body has been stored, not a few will be surprised to find that the top is in very bad condition when the first rainy day comes and the top is pressed into service.

The materials used in top manufacture are cotton twill, mohair, leather and imitation leathers known by the name of auto leather and Pantasote. The twill and mohair combinations are largely used for tops for cars larger than a demi-tonneau, while for high-grade runabouts and victorias leathers and imitation leathers are often employed. Dealing first with woven top material, it must be borne in mind that this is called upon to stand a good deal of friction and, being constantly subjected to climatic changes, must needs be of good material to withstand rot. The class of goods that sometimes finds its way into cheap tops is not waterproof, and, in the case of a heavy downpour or of exposure for any length of time in the rain, will permit the moisture to penetrate and leak through into the car.

The usual material employed is made of two layers of fabric cemented or vulcanized together with a rubber compound. This makes the two layers as solid as if of one piece and renders them waterproof. The rubbering or vulcanizing process is one of the most important factors. Upon the manner in which this is carried out, the amount of rubber used and, above all, the quality of the rubber employed will depend the serviceability of the top. The exterior and interior layers of fabric often differ in quality, and where mohair is employed the exterior layer is mohair while the backing, so to speak, is usually cotton twill. A cheaper class of material is plain twill, where two layers of the twill are vulcanized together. Referring to Fig. 2, an example of this will be seen. The different layers are marked and denote the different surfaces after the two have been pulled apart. A and D are the two surfaces representing the interior and exterior of the top and B and C the reverse of these. From the blackened effect of B it is plain to see that this side has received the coating of solution and that the lighter colored surface C has been placed on B and cemented to it. A similar-looking material may cost considerably more per yard in the case where both surfaces have been coated, in which case the material is twice as waterproof. An example of this will be seen in Fig. 8, where the part B is alike for both surfaces, while the appearance of the exterior surfaces is the same.

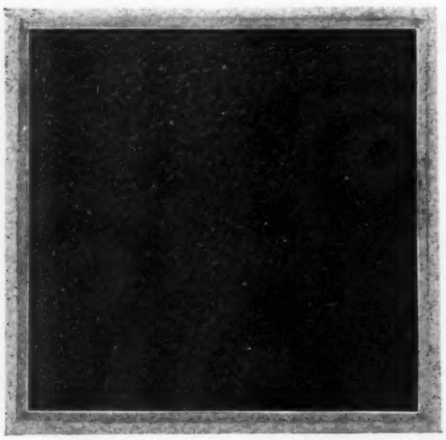


Fig. 1—Close grain Pantasote used largely in the manufacture of tops and dust boots

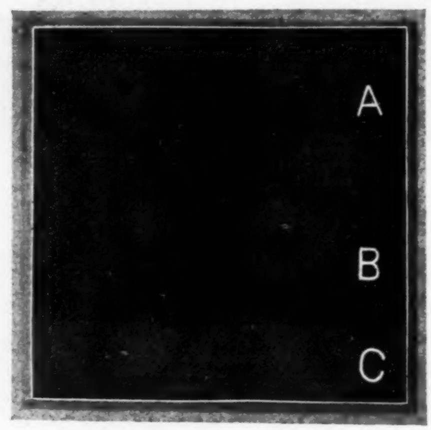


Fig. 4—Mohair backed with a cheap grade cotton fabric. The rubber compound used in this case was poor and sparely used

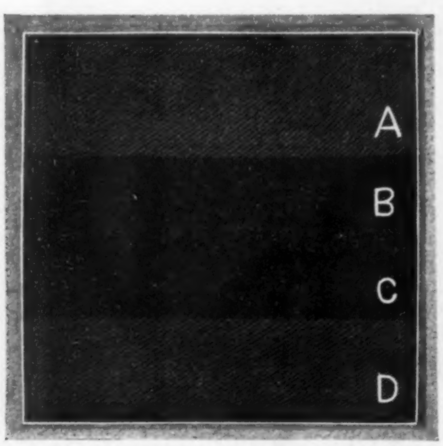


Fig. 2—Layers of cotton twill top material pulled apart, showing the rubber compound adhering to one side and not the other

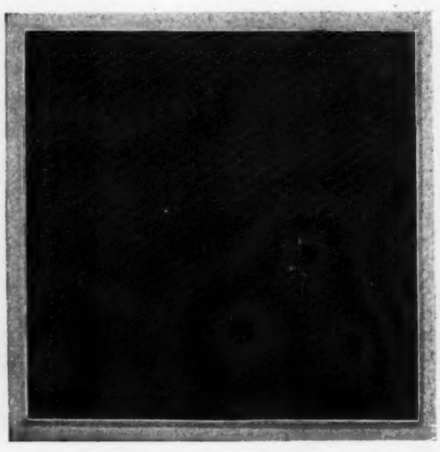


Fig. 3—Showing the grain of mohair with a pattern interwoven to improve the appearance.

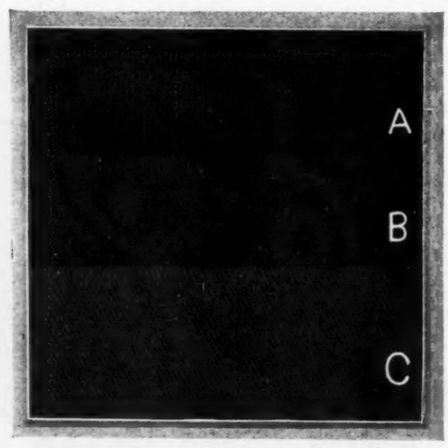


Fig. 5—High grade mohair top material backed with good cotton twill, with sufficient first quality rubber compound to fill the interstices of fabric

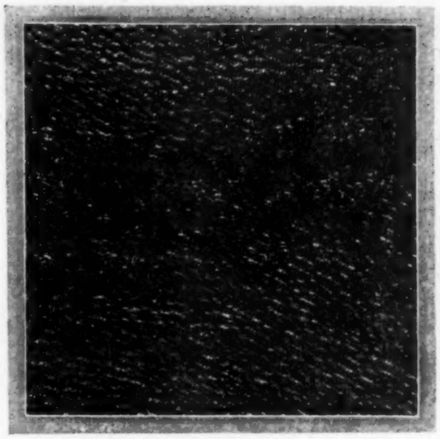


Fig. 6—Leather for tops, giving the idea of a medium grain leather suitable for victoria tops and dust boots

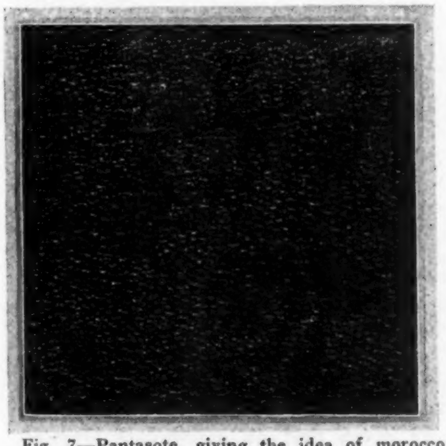


Fig. 7—Pantasote, giving the idea of morocco leather, while at the same time being strong, is considerably lighter than leather

The appearance of a top made of mohair is far superior to that made of ordinary fabrics, such as cotton twill. It has a decided luster and is non-absorbent; consequently the rain runs off it very easily. Mohair is goat hair and is a good deal coarser than cotton; consequently the meshes of the weaving are larger than those found in cotton twill. There are several imitations of mohair which are in reality made from cotton, with a little silk added in the manufacture to give the required luster. In these, the silk very soon wears off, leaving the material ragged. The mohair stratum is very thin and when seen in the unsolutioned state has the appearance of a thick veil. For this reason it is inclined to wear and fray if the slightest friction is allowed while the top is folded. Mohair requires very careful handling in the manufacture, and only the best quality of rubber solution should be used with it; otherwise it will become detached from the foundation and fray. Fig. 3 shows a good quality mohair with a decided pattern for ornamental purposes. It is backed with a stout cotton fabric; the stoutness and wearing qualities of mohair tops are dependent to a large degree on the thickness of such backing and the quality thereof. Fig. 4 represents a mohair material, A, on a dark gray cotton backing, B, after the two have

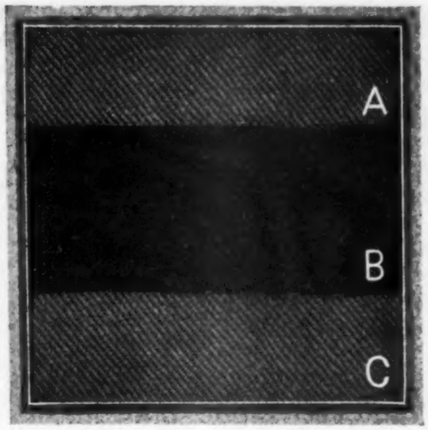


Fig. 8—Top and bottom layer of cotton twill with plenty of rubber compound used to make a proper waterproof material

been pulled apart. The mohair is very close-grained and is of good quality, but the cotton substance can easily be seen at B. C in the same illustration represents the cotton after being coated with the solution; it will be noted that the appearance of cotton has entirely vanished, leaving a clean stratum of rubber. Some of the rubber adhered to the mohair, but the amount used in the manufacture was insufficient and heat would play havoc with what there was and spoil the waterproof qualities.

The conventional pattern of mohair of which tops are made is shown in Fig. 5. Seen with the naked eye, the appearance of hair is very marked and has the form of undulations intersected with a single cross-strand at equal intervals. It is backed with a stout section of cotton twill, has a decided luster and gives a good car a decidedly finished appearance. The mohair effect can be seen at A and the cotton backing at C. A close examination of B will show that the rubber is paramount therein, and the cross-sectional effect is in reality the grain, so to speak, of the mohair that has left its impression behind. The effect is different in Fig. 9, where a coarser weave cotton has been used with the same grade of mohair. C in this case represents the cotton and A the mohair. B is the cotton that has been coated and pulled from the mohair afterward, and D the coated cotton before vulcanizing. D is in reality shiny and has a decided tacky surface, while the effect of the vulcanizing is to harden B and fill the interstices, rendering the entire material proof against the elements.

Grays are very popular in top manufacture; a sample of this color will be seen in Fig. 10. It is composed of alternate strands of gray and black hair, but these can be varied in many ways to give the requisite shade. The color of the material used is no indication of the quality, although if a special shade is desired that does not come through in the ordinary course of manufacture it will probably cost more to have the material specially dyed.

Where a leather effect is desired a ma-

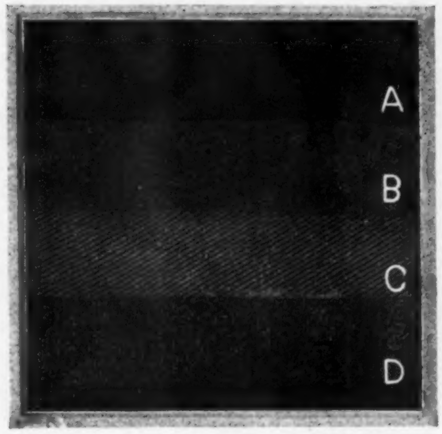


Fig. 9—Showing top layer of mohair and the rubbered cloth after former has been pulled apart. C, course backing; D, solutioned surface

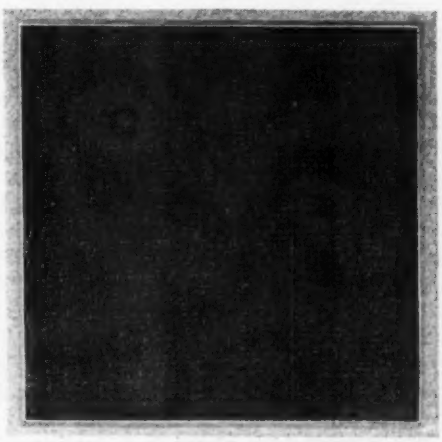


Fig. 10—Gray mohair top material, in which the layers of light color can be seen that give the gray effect—it has a luster that cannot be obtained in cotton

terial known as auto leather is largely employed. It has the appearance of leather, but is in reality a composition that is mounted on suitable backing, either of cotton wool or mohair. Cotton is often used, owing to the fine mesh and its ability to more readily absorb the waterproofing material. Any type of leather can be imitated nowadays, ranging from a delicate morocco to the ordinary hide variety. The type shown in Fig. 6 is intended to give the appearance of a medium-grade hide, and the thicker the material—or, in other words, the thicker the coating of the compound—on a stout twill or mohair the better it looks and the longer it will last. Sun, heat and damp are the enemies of this material, as it is liable to crack, in which case the rain will find an easy path through the cracks and in time it will rot the backing. Pantasote is usually thinner than the average run of auto leather and is consequently more pliable and less inclined to crack in the folds. The form shown in Fig. 1 very closely resembles leather.

The materials used for the purposes of illustrating this article were supplied by the Empire Top Co., of 529 West Fiftieth street, New York City, where the concern has a large top-building factory.

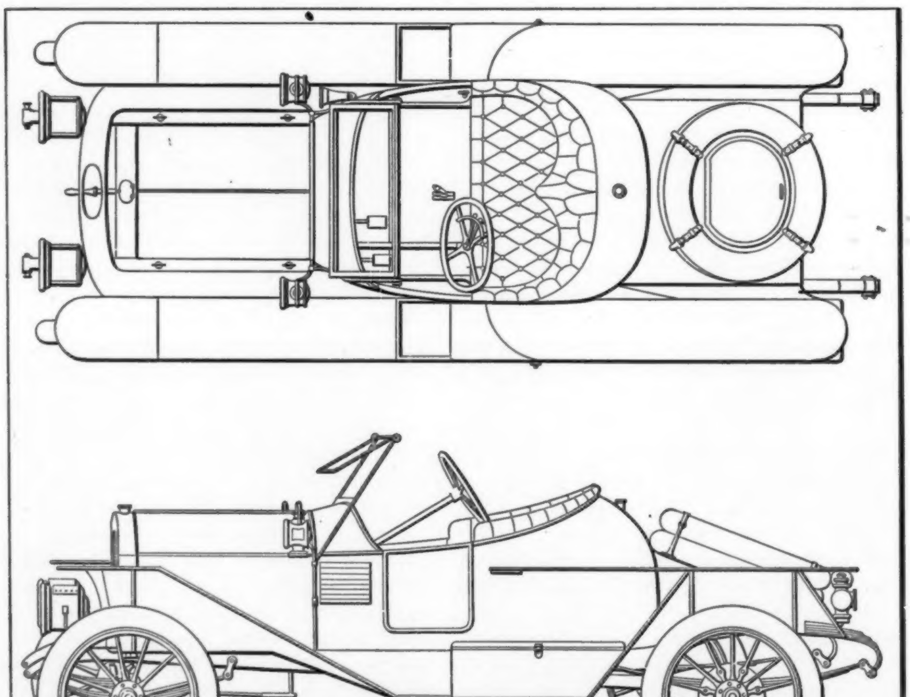
Novelty in Runabout Body

The coming of the foredoor type of body, enclosing the space bounded by the driver's seat and the dash, brought an extra measure of conjecture, and the fear was that overmuch of heat would come through the footboards and smother the pleasure that normally belongs to the directing of an eager automobile. Time will have to state whether or not the troubles of this sort have been over-estimated, but the new type of runabout body, which is here suggested by illustration, annihilates speculation, and presents the solution of several of the problems that confront purchasers of automobiles at the present time.

A LARGE contingent of experienced automobilists, having tried out the good qualities of the more pretentious forms of automobiles, are expressing a preference for a well-made car, with a motor of some power, and a body that will seat two persons, with the seats so arranged that the control of the automobile will not be interfered with by a poor distribution of the weight, offering the further advantage of easy riding qualities to the occupants of the car. The new body, as here shown in plan and side elevation, is of the enclosed type, but in order to afford a controlled measure of cooling of the space within, a barriered ventilator is placed on each side, back of the dash, in front of the doors.

The second innovation is in connection with the locating of the gasoline tank within the bulging of the body back of the seat, with a filler protruding through the turtleback on the center line. The tank is of excellent capacity, is protected in every way, and unsightliness is dispensed with, as the illustration clearly shows. The space at the rear of the gasoline tank is taken up by a tire sling, which is designed to hold two tires, and the circular space, over which the tires are fitted, is suitably enclosed, forming a tool box of some capacity, with a cover and a lock, protecting the tools from the coaxing wiles of a stray passer-by.

A windshield is placed in a slanting position on the cowl, the latter having considerable overhang, and this arrangement, counting in the facility of a movable visor on the windshield, adds a considerable measure of comfort. The chassis on which the body is placed has a wheelbase length of 120 inches, and the body space back of the dash line is 93 inches.



Plan and elevation of a new type of runabout body with a ventilated front, enclosed gasoline tank, and place for tools and tires

Cause of Carbon Deposit

If "cracking" can be prevented, there will be no trouble experienced from the formation of carbon in the combustion chamber. Upon the carbureter devolves the task of properly vaporizing the gasoline and insuring uniform combustion.

UNLESS carbureters are so designed that they will vaporize automobile gasoline, it will, of course, pass into the combustion chamber in liquid form, where it will "crack," precipitating carbon, forming a hard crust, which interferes with the proper thermal action of the motor. Cylinder oil plays a small part in this malperformance, since it serves as a binder for the precipitated carbon, to which must be added silicon and other silt formations, which are sucked in through the orifice of the carbureter, and carried into the combustion chamber.

8,000 Miles Cost $392.75

Dr. Robert M. Rogers, of Brooklyn, N. Y., presents an itemized statement of the cost of running a Franklin Model G automobile 8,000 miles during the year 1910, using this car as a business proposition for the most part.

SERVICE, from a doctor's point of view, is founded upon prompt response to demand, and the covering of the greatest possible area, consistent with the main requirement. There is no authentic record which will show the number of miles per day that a doctor would be able to make in his professional capacity were he to walk, but it will be seen by an examination of the account here given that an automobile traveled 8,000 miles in doctor's service, which is not far from 25 miles per day for every working day in the year. It is scarcely to be expected that a doctor would walk, making the rounds of his patients, even half of this distance, and it is pointed out in this particular example that, in addition to traveling 8,000 miles in his automobile, Dr. Rogers accomplished some of his undertakings without using the car. The conclusion that will be reached upon examining the cost record is that the automobile was a good business investment in this case, and in studying the details of the cost, after the item covering storage is removed, a remarkable economy is brought to light. The gasoline bill, for illustration, was $73.52 for 510 gallons of gasoline. The amount of gasoline actually used was obviously low; the price per gallon is a trifle high. The cost for tires, and the repairs thereof, was very modest. One or two of the items would suggest that they are not of the type called recurring.

Cost of Running an Automobile 8,000 Miles

Gasoline (510 gallons)	$73.52
Storage (12 months)	174.90
Tires and repairs	83.73
Oil and grease	11.30
Starting crank	6.00
Idler gear	8.80
Glass (windshield)	1.00
Weed chains	4.00
Soldering gas tank	1.50
Adjusting bearings	13.00
Electric horn and batteries	15.00
Total	392.75

Short Stories of Wide Interest

Unraveling the Puzzling Situations

Among automobilists discussion seems to be unflagging as it bears upon some of the situations in relation to which the natural intricacies readily support the difference of opinion, but it is the contention here that a common sense view of such matter should prevail; moreover, point of view should be given its measure of recognition.

LUBRICATION is generally thought of from one angle only. The average automobilist thinks that the lubricating medium, be it oil or grease, does its full duty when it provides a slippery surface between the journal and the box. Were this true, a ball bearing running dry would satisfy the whole situation, since the coefficient of friction of a dry ball bearing is low enough to assure a continuity of performance, without an undue loss of power. The lubricating medium has other duties to perform, it being the case that the polish on the journal should be maintained, or if ball bearings are employed, one of the functions of the lubricating oil is to preserve the highly polished surfaces, and the third duty of the lubricating product is to seal the bearing so that foreign substances may not enter and perch upon the surfaces for no better purpose than to serve as the abrasive, which if present will soon reduce the high polish on the surfaces to a wretched level. In a broad sense, then, lubricating oil has three prime duties to perform, and the qualities of the oil, in view of the necessities must be (a) of the requisite unctuousness, (b) of the right body consistency, and (c) free from an acid or alkaline reaction.

Considering (a) dealing with the unctuousness, in other words, the slippery qualities of the lubricant, this property must be present without abatement under temperature changing conditions; considering (b), which has to do with the body or consistency of the oil, it is believed that in addition to the selection of the same of the body that is most efficacious for a given purpose, it is also desirable to select the oil for its constancy of mobility so that as the temperature increases the oil will resist thinning down, and in dealing with (c), which has to do with the etching propensities of the lubricant, it is enough to observe that the oil should neither be acid in its reaction, nor should it be composed of constituents that will undergo chemical change either in the presence of light or in the presence of aging, but it is just as much of a detriment to use an oil that is "caustic" as it is to employ an acid product since the highly polished surfaces of the balls and raceways of the bearings will measure the same amount of damage if they are etched by a caustic product as will be produced if the etching is due to an acid reaction.

DEPRECIATION of an automobile may be traced to (a) inferior material, (b) bungling workmanship, (c) inharmonious design, (d) poor fitting, (e) neglect to maintain the automobile after it goes into service, (f) bad roads, (g) high speed on good roads, (h) high speed, considering bad roads, and (i) overloading.

The considerations (a), (b), (c) and (d) must be coped with by the maker of the automobile, and the subdivisions (e), (f), (g), (h) and (i) come under the observation and care of the user of the automobile. In the purchase of a car the man who pays for it will have to suffer if he neglects to take account of the extent to which the maker's considerations are present in the finished product, and in the after use of the automobile it will be within the confines of prudence to pay attention to the things that represent undue depreciation, remembering that the life of a car from the speed point of view follows the square law, so that if the speed of a car is reduced to one-half of the speed of a similar automobile, the lower speed machine will last four times as long as the one that is driven at the higher rate of speed. Between low speed, cleanliness and good conditions of lubrication the life of an automobile may be prolonged to a far greater extent than is generally realized. The fact that the materials of which an automobile is made are extra fine is a sparse compensation in the face of abusive speeds, because the good materials do not go up according to the square law, whereas the depreciation must feel the inevitable force of the rule. If the automobile is to last a long time, clean it when it gets dirty, oil it before exacting service, and go slow.

NOW that the sun is shining on both sides of the street, and a favorable wind is drying up the slimy pools that have long abided in hidden places on the highway, the automobilists who stored their cars for the Winter are busying themselves in their divers pursuits, but they all have a common idea, which, when it is put into force, will see them skimming along the road, bowing to budding Nature, and re-forming the somewhat intimate acquaintance with the scenes that intercepted the eye on former excursions under like conditions. Not a bad picture to contemplate, but quite a number of these "sanguinarians" are meeting obstacles that are the children of their lack of foresight, and being thus endowed, they are prone to blame the makers of the automobiles, or the dead storehouse wherein the cars were kept, for the ills that beset them. It was only the other day that a learned citizen whose vocation is the making of glue, complained most bitterly that he was unable to make his automobile mind after he took it out of dead storage, and he said in tones of despair "The motor does not show enough power to turn the blame thing over." In an inquiring state of mind, and in soft tones, we went into the ramifications of glue-making, and after he got through describing the process, which was very interesting indeed, we were amazed at discovering that there was no great difference between the way that he went about manufacturing glue that he sold for a livelihood, and the method that obtained in the production of the glue that prevented his automobile from working. When the car was put out of commission last Fall, instead of cleaning out the slimy mass that represented what was left of the lubricating oil in the various places where it stayed in the car, it was permitted to remain, and the time of storage, considering the previous state of the product, was sufficient to accomplish the remaining damage. Unfortunately, in addition to the gluing of the parts together so that they were prevented from functioning, the oil took on an acid phase, and the bearings, not forgetting the journals, were rusted up; and ten dollars' worth of foresight, which was lacking, resulted in a thousand dollars' worth of damage that the poor glue maker will now have to face.

BRITISH WAR DEPARTMENT TO TEST TAXICABS—Great Britain is going to make a test of taxicabs for military purposes. The War Office has taken its cue from the taxicabs which have proven so satisfactory as shuttles of quick communication in traffic circles in London and English provincial cities. It is proposed to give the taxicab a thorough trial during the maneuvers which are to take place this month.

Care of Varnished Surfaces

M. C. Hillick gives some timely advice concerning the proper care of the sensitive and highly susceptible body finish without which even the most expensive pleasure car is incomplete. It sometimes happens that in the effort to preserve the varnished surface it is coddled to death under heavy coverings—varnish must have light and air if it is to last a reasonable time.

VOLUMES might be written on this subject, but the pith of the whole matter is that it is the easiest thing in the world to overdo the business of caring for the newly varnished surface. Anything that costs six good dollars a gallon, and is cheap at that, cannot very well be otherwise than sensitive and highly susceptible to influences and effects created by the atmosphere, prevailing impurities in the air, and inimical conditions generally.

The best possible varnish, the varnish that stands out with a wonderful brilliancy and protects all the surface finery beneath it to the end of the chapter, cannot endure the cleaning and caretaking processes bestowed upon it by many zealous but misinformed friends. For of a truth there is a right and an entirely wrong way of going about this cleaning and polishing up business. Varnish must be given an opportunity to live and wear natural, like any other normal thing. It can be cleaned and rubbed to death, and its funeral attended, before you are aware of the event unless some expert observation and rugged common sense are called into play.

Never, under any circumstances, scrub varnish with a brush. Neither use hot nor dirty water upon it. Avoid cleaning the surface under the hot rays of the sun. Do not use an alkali in the wash water, nor soap, nor washing powder, nor any other medium harmful in the least degree to the varnish. The automobile should not be housed in quarters adjoining a horse stable, nor in quarters formerly devoted to such purposes, for here, as perhaps nowhere else outside of an ammonia factory, the fumes and poison emanating from this pungent alkali are in dangerous circulation. And it fairly goes without saying that ammonia is sure death to the life and vitality of varnish under any and all circumstances.

Do not wipe mud or dust nor other accumulations from the surface; rinse all surface substances of whatsoever sort, excepting, of course, oil and grease, from off the varnish with a gentle flow of water applied either with a soft wool sponge or through a hose operated under light pressure. Varnish does not long endure a heavy pressure stream of water directed upon it from the hose. It has a tendency to fracture the film just as you might crackle a piece of glass by tossing a pebble upon it. If it doesn't do this it at least beats down the natural luster of the varnish and strains the fabric to the limit, whereas the washing of the surface should heighten the luster and give to it a transparent quality which road service and the dust and the mud of the highway, in a measure, robs it of.

It is bad practice, moreover, to use a dust brush feather duster, or even the fleecy, fluffy dusters at one time considered indispensible in the carriage repository for whisking off the dry dust or dirt from the automobile surface. It dulls and scratches and despoils the varnish of its luster. It is a practice that ought not to be tolerated.

Still another custom adhered to in automobile showrooms and garages consists of blanketing the car under a great sheet of muslin or canvas for protective purposes. This custom promotes the discoloration of the varnish causing it to turn green. Many very beautiful colors have been credited with lack of permanence and color stability through the change which the varnish undergoes when kept closely covered with cloth or canvas, or when regularly stored in dark, ill-lighted quarters.

The wareroom or the garage should have plenty of light of a soft, subdued sort, and in addition to this good agency it should be provided with ample means for ventilation. This is one of the mediums by virtue of which the brilliancy and durability of the varnish is preserved.

From the painter's standpoint, which in the final analysis is the standpoint of the automobile owner, the oils and cleaners, renovators, and so on, should be kept off the surface of varnish until the necessity for their use actually exists. The constant fussing with the surface, beyond the washing already recommended, using dope often wonderfully and fearfully made, is about the surest way to wear out the varnish that can be devised by the owner of the car.

The so-called emulsion cleaners are, primarily, mediums in which water and either an alkali or an acid, or both, are present. Such a cleaner, applied to the surface, and then with waste or other soft fabric rubbed off, is harmful to any varnish that has not passed into its old age, or lost through accident or abuse the full flush of its beauty.

When the time comes that some kind of a cleaner or renovator is a necessity upon the surface choose one that is free from alkalies and acids—a neutral cleaner, in short. But by way of a foreword to this procedure permit us to say, defer the practice to the latest possible date. As a matter of fact, when this state of wear is reached it were better to stop the car and pay for a fresh application of varnish, thereby giving it newness of life and an appearance to arouse jealousy.

Finally, during these spring days, when showers and mud prevail, wash the car after every run, or, at any rate as often as it becomes bespattered. Mud left to dry upon the varnish extracts the oil therefrom, devoid of which the varnish spots and loses its brightness. Good care-taking of the car means shining gold and increased happiness to the owner.

Syrians Mending Roads

This with a view of the ultimate introduction of the automobile, especially for commercial purposes. As the local merchants are well disposed toward Americans, there seems to be no reason why the makers of this country should not do their part in furnishing the cars the demand for which is bound to follow upon the improvement of the highways.

THE section of Syria known as Aleppo is beginning to get into touch with the modern desire to possess automobiles, and a passenger and freight service between Aleppo and adjacent cities is being strongly anticipated as well as advocated. The local governments of the local towns in Northern Syria have promised to make the roads, which now are in a very bad condition—and actually vile in rainy weather—fit for automobiles to travel over. The Turkish Government has granted a concession to a French concern to repair 10,000 kilometers (6,213 miles) of the public roads in the Empire. This will embrace the building and the rebuilding of grades and bridges. A citizen of Aintab has purchased three automobiles with a capacity of five passengers each and one car with a six-passenger capacity. These automobiles are now making regular trips over the seventy-five miles of highway which lies between Aintab and Aleppo, covering the distance in from five to six hours. But the adverse conditions of the road make traveling rather a dangerous business. All of the automobiles in use are second-hand French-made machines, except one, which was manufactured in America. The regular road gauge in Syria is 5 1-2 feet. Gasoline, which is imported from America and Roumania, fetches 35 cents per gallon. There is no garage in the vicinity of Aleppo, nor is there any person who is especially engaged in the sale of automobiles, the business being done through a local general commission house or direct with the exporters in America or Continental Europe, in the event of the purchase of a machine being contemplated. If American manufacturers were to go after the business in the right sort of way—that is, in conformity with the local trade customs—they would have no difficulty in controlling a good share of the patronage which, up to the present time, has gone to French manufacturers of automobiles.

Wheels, Ancient and Modern

With Some Account of Their Origin and Manufacture

At the regular meeting of the Royal Society of Arts (London) on April 7 the principal paper, of which the following is a digest, was read by Henry L. Heathcote, B.Sc. The object of the paper was to present an account of some of the most ancient and most modern wheels, to describe their form, the materials used in their construction, and, as far as possible, the methods employed in their manufacture. Mr. Heathcote limited his argument almost exclusively to vehicle wheels, no attempt being made to follow the application of wheels in the many arts which employ them. (Second installment.)

The deformation of a tire by load is resisted because the radially acting air pressure puts the tube and cover in considerable tension. The rim of a suspension wheel is the reciprocal of this, being in compression due to the radial components of the spoke tension. The rim flattens like a tire under load or shock, the radial tension in the one case acts like the air presssure in the other; the greater the tension the less the rim flattens, and the less the tension the "softer" is the wheel.

Wheel-building is the counterpart of tire-inflating, and the art produces its best when sufficient tension to produce torque rigidity is combined with conditions that develop in the wheel a maximum cushioning effect. Such a wheel, by co-operating in the duties of the tire, lengthens its life and lessens its liability to wear, cuts and punctures. To obtain maximum cushioning from a wheel of this type, moderate spoke tension needs to be combined with a flexible and resilient rim and thin spokes. This in its turn implies not only careful choice of materials, but appropriate design to neutralize the reduction of resistance to torque perpendicular to the plane of the wheel entailed by lightening the rim. Both the wheels of antiquity, modern artillery wheels and wheels for motor cars owe much of their lateral strength to the high moment of inertia of their heavy wooden felloes, the disadvantage of which is their inflexibility and consequent inability to absorb shock. The Rudge-Whitworth wire wheel for motor cars (Fig. 2) is the first wheel in which these requirements were adequately met. This is done by making the outside spokes, that are much dished, enter the rim near its edges and not at its center, as was formerly considered correct. In this way members are provided to oppose the twisting of the rim due to sideways shearing of the tire when rounding corners.

It is only fair to add that this method of spoking has the effect of localizing the bending stresses, due to the pull of the tire bead, in the edge of the rim. This is met by strengthening the rim bead, which at the same time strengthens the whole wheel very considerably.

There is another point of similarity between the wire wheel and a tire segment. If the radial compression on tire walls gradually decreases owing to air escaping from the stressed condition, the flexed part of the tire will be increased, and a point arrives at which this has to be neutralized by inflating. Similarly, if the spoke tension of the wire wheel should fall the flattening of the rim would increase, and might even reduce the spoke tension to zero.

Fortunately, solids are more easy to manage than gases, and by employing spokes of high elastic limit, and by cold-working the metal of the hub shell round the spoke heads and of the rim around the nipple holes by hammering and bulging (coupled, of course, with proper design and materials), the vibration elastic limit, above which permanent escape and loss of tension would occur, is made so high that after a slight initial bending the ordinary stresses are insufficient to "soften" the wheel. In any event, the spoke tension can be adjusted readily. It is not to be supposed that even a wheel of this advanced type is capable of absorbing as much shock as a tire. The air pressure in the inner tube of a motor tire ranges usually from about 60 to 90 pounds per square inch, but the corresponding normal pressure on a Rudge-Whitworth wire wheel rim ranges from about 150 to 200 pounds per square inch. This, combined with the fact that the rim is not nearly so flexible as a tire cover, accounts for its inferiority to the tire as a shock absorber, though the much larger diameter of the wheel operates in the other direction.

Large-diameter wheels—like large-section covers—are, *ceteris paribus,* better shock absorbers than small ones. The superiority of this type of wire wheel as a shock absorber, compared with compression wheels with radial wood spokes, is a matter of actual experience as well as of conjecture, and is noticed in their more constant contact with the ground under similar conditions of use.

Evolution of the Motor-Car Wire Wheel

The first wire wheels to be used for motor cars were bilaterally symmetrical like the front wheel of a bicycle. The spokes were headed and bent near the head through 90 degrees (see Fig. 2). The holes in the hub flanges were drilled parallel to the axle, and the spokes threaded through these holes were attached to the rim by nipples screwed on to the other end of the spoke. But, as in living structures, so in engineering constructions, evolution brings gradual morphological differentiation of structure and further division of labor. In the early bi-

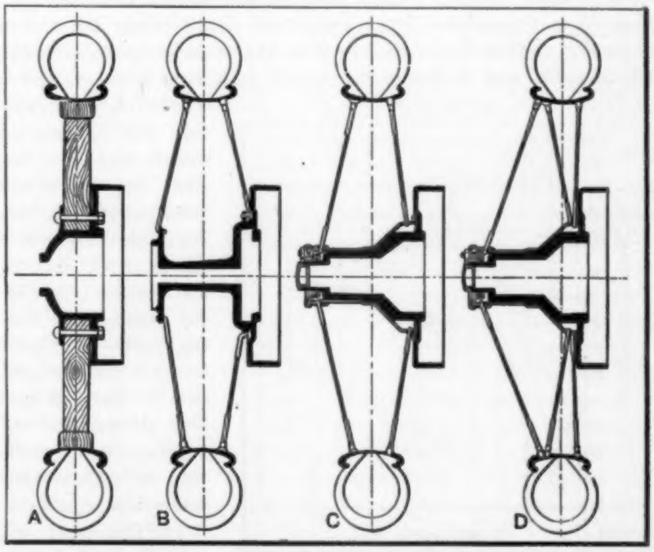


Fig. 2—(A) Fixed wood wheel. (B) Fixed symmetrical wire wheel. (C) Rudge-Whitworth detachable wire wheel, patent dished construction, double-spoked. (D) Rudge-Whitworth detachable wire wheel, patent triple-spoked construction

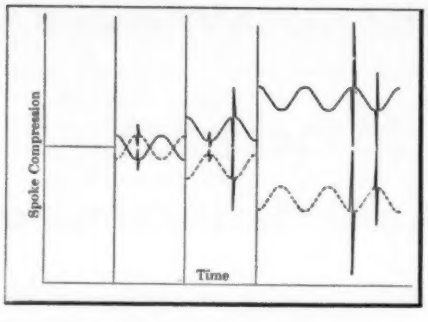


Fig. 3—Diagram illustrating fluctuations of spoke tension in a wire wheel

laterally symmetrical wire wheels both inside and outside spokes transmitted the drive. In the present Rudge-Whitworth wire wheels, to prevent the stresses rising too high when rounding corners or when skidding, the wheels are dished and the outside spokes are relieved of the whole or greater part of their share in transmitting drive. This is done in some types by making the hub of much larger diameter at the end near the car than at the other end. As a result of this the displacement of the inside spoke heads under torque is greater than the displacement of the outside spoke heads, the ratio of the displacement in the direction of the spokes (and therefore of the added tension) being the ratio of the diameters of the circles to which the spokes are tangent. In other types the end of the hub to which the outside spokes are attached is revoluble, so no torque is transmitted by them and their whole strength is reserved for resisting side thrusts.

Another departure from symmetry which secures greater strength for the inside or driving spoke cone is the employment of 50 per cent. more spokes inside than outside. In the hub shells the spoke holes are not drilled parallel to the axle, but perpendicular to it. This enables spokes bent through a small angle to be used; for instance, the inside spokes that transmit the drive are only bent through 45 degrees, and this, coupled with a special way of producing the bend and careful scrutiny in the firms' laboratory, has enabled the strength at the bend to be increased from about 60 per cent. (with the 90-degree bend) to over 90 per cent. that of the body of the spoke. The outside spokes are bent through less than 45 degrees, so the strength at the bend is still less impaired. Another improvement is the addition of another cone of spokes, making three in all, so that the drive is transmitted to both sides of the rim. The same device enables the point of contact with the ground to be more nearly under the bearing or steering knuckle (see Fig. 2).

I will next show you a diagram (Fig. 3) illustrating the fluctuations of spoke tension (or compression in a compression wheel) under some of the conditions of use, assuming that the rim is not flexible. When the wheel is jacked up revolving does not appreciably alter the spoke tension, and it does not vary with time, so is represented by a horizontal line. When the car is in steady motion and free-wheeling the tension on each spoke will increase and decrease, the values following a cosine curve (as already explained) the X axis of which should be below the minimum points. The zig-zag illustrates the effect of a shock due to the wheel leaving the ground and falling back suddenly to its former condition. The dotted line shows the instantaneous condition of a spoke diametrically opposite.

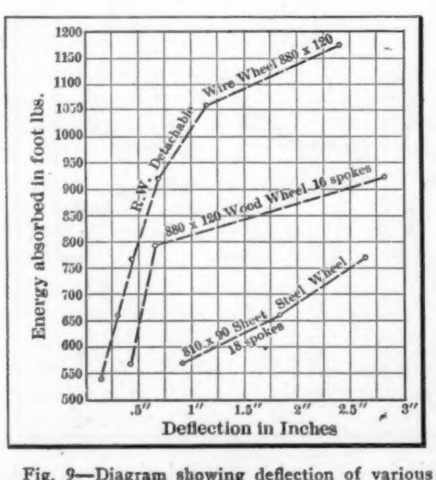


Fig. 9—Diagram showing deflection of various types of wheels subjected to increasing blows in the same place.

In the next we see the variations in tension of the spokes of a driving wheel traveling straight, and the next shows the variations when the wheel is being driven round a corner. It is important to notice that the effect of the same shock is very different in the different cases, and depends on the instantaneous value of the spoke tension as well as on the position of the spoke in the wheel. The variation set up in good wheels will follow the diagrams pretty closely, but actual experiments with wire wheels show that the increment of tension due to load, torque and load and torque combined is not nearly so great as those diagrams indicate.

Experiments with Wire Wheels

Fig. 4 shows a polar diagram of the tension on the spokes of a Rudge-Whitworth detachable wheel fitted with a tire sustaining a load of one ton. About one-quarter of the spokes have their tension relieved, but the others experience nothing like the same increase, and it is distributed fairly evenly all round.

To test the effect of combined load and torque the pull was applied to a dummy tire made of iron, so that its line of action did not pass through the center of the wheel. By varying the distance between the wheel center and the line of pull the ratio $\frac{\text{load}}{\text{torque}}$ could be varied at will. In this way tests imitating all sorts of conditions of road surface, car load and horsepower engine have been carried out.

Fig. 5 shows a polar diagram for a wheel having the same number of outside and inside spokes, the outside spokes of which transmit their pull to the hub and not to a revoluble ring. The outer line indicates the initial tension on the inside spokes, the inner that on the outside ones. The outer line shows the effect on the tension of the combined load and torque. In this test the inner hub, the hub-shell nipples and the rim are all tested, and the results demonstrate beyond controversion the enormous strength of these wheels for forces and couples in the plane of the wheel. The point to which I would particularly call attention is the great advantage of a flexible rim which, as these results show, quite obviates the high tensions or compressions which would otherwise obtain and which would prove so destructive every time the wheel was jerked off the ground.

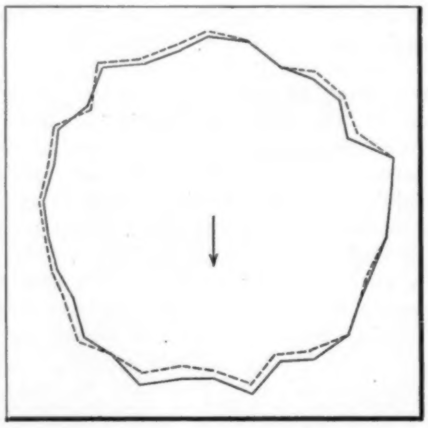


Fig. 4—Polar diagram of spoke tension on a Rudge-Whitworth detachable wheel

In addition to determining the effect of load and torque, separately and combined, we have subjected both wood and wire wheels to a side-pull applied at the rim or to a dummy tire. Fig. 6 shows a Denison testing machine adapted to imitate the stresses set up in rounding a sharp corner at very high speed or in a bad side-slip. The results of some of these tests will be seen in Fig. 7. In nearly every instance the deflection of the wood wheel for the same pull is greater, and in every case the wood wheel sustained permanent damage at a lower pull than in the wire wheel. The same applies to the sheet-steel wheels. The arrangement of the spokes in the Rudge-Whitworth wire wheel has been the subject of careful design and experiment. Fig. 8 shows the results of some of these experiments, and makes it clear that the strength attained, even with precisely similar rims, hubs and spoke material, depends greatly on the design selected. These tests have given valuable data as to the best designs and materials for the rims, spokes and hub shells.

It does not follow, however, that designs and materials proved suitable for withstanding a steady force are also suitable for impulsive forces, so the various types of wheel have been investigated under impact.

The next slide shows the impact pendulum ready to be released against the top of the rim of the tired wheel. The length of the pendulum is about 12 feet and the bob weighs nearly a quarter of a ton. In some tests increasing blows were applied to the same part of the wheel, in others a moderate constant blow—*e.g.*, 200 foot-pounds—was applied at successive points on the rim eleven-thirtieths of the whole circumference apart. Fig. 9 shows characteristic diagrams for wood, wire and sheet-steel wheels subjected to increasing blows at the same place; and Fig. 10 shows the results of testing wood and wire wheels with similar blows, the wheel being turned eleven-thirtieths of the way round after each blow.

The question will probably suggest itself as to whether a motor car wheel is ever called upon to stand side thrusts and blows as great as those represented by the upper part of Figs. 7 and 9. The magnitude of the stress depends in every case, not entirely, but primarily, on the force that the ground can exert on the wheel. For instance, the forces that turn a car round a corner reside in the ground. It is quite a mistake to suppose that the driver at the steering wheel really steers the car; the path followed may be indicated by the steerer, but it is dictated by the ground. The most the driver can do is to turn the wheels into such a position that, if the ground permits, the forces developed under and near the wheels will alter the direction of the car to the desired extent.

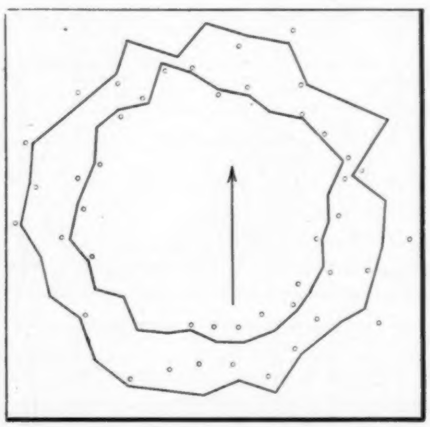


Fig. 5—Polar diagram of wheel with outside and inside spokes

The stresses set up when rounding corners without skidding have been very fully investigated by J. V. Pugh (*Autocar*, 1906, pages 910 and 948). When traveling at twenty miles per hour round a curve of 30 feet radius the side thrust on an outside wheel, at the tire, may be as much as one and one-fourth times the load on the wheel when traveling straight. When skidding, the side thrust may be considerable, not only when stopped by a curbstone, but also when the side-slipping wheels are arrested by a dry, sandy or rough part of the road.

If the rear wheels of a car weighing one ton skid sideways at a corner and are brought to rest by the outer wheel running on to a dry, rough or sloping part of the road, and if two-thirds of the load is borne by the rear wheels, and they attain a sideways velocity of five miles per hour, and stop after sliding three inches beyond the slippery part, then, taking moments about the front wheels, the retarding force is

$$\frac{2W}{3}\cdot\frac{v^2}{2gs}=\frac{2}{3}\cdot\frac{2240\times 53.8}{64\times 25}$$

$= 5020$ pounds approx. on one wheel.

On a smooth surface, even if dry, the ground would not exert so great a force on the tire, but when rough and sloping even greater forces can be exerted.

Having now shown the superiority of wire wheels as shock absorbers, under load and torque, under side torque driving and shock in a direction vertical to the plane of the wheel, I will give a brief outline of the tests that are regularly carried out in the Rudge-Whitworth research laboratories to maintain the standard of excellence. It will perhaps, be convenient to start with the hub where the torque is applied and proceed via the hub shell, spoke heads, spokes, nipples and rim to the tire.

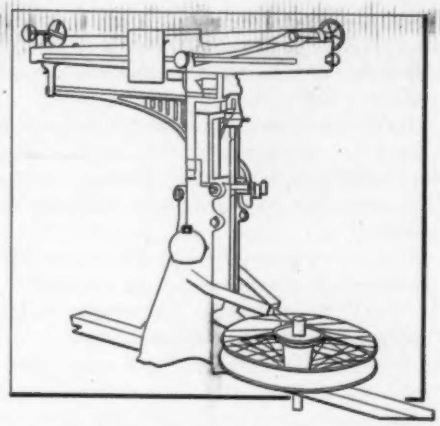


Fig. 6—Denison testing machine used to show effect of load and torque on a wheel

Inner Hubs.—The inner hub, which is of steel, is keyed on to the axle and has a series of keys which engage with similar slots milled inside the hub shell (Fig. 11). The material is analyzed; its tensile strength, elongation and contraction determined, and, as its main duty is to resist shear and transmit torque, test pieces are clamped in a vise and struck by an impact pendulum. From the sectional area of the piece, and the difference between the arc traversed after impact and the arc when there is no test piece in the vise, the energy absorbed per square inch can be calculated. The results are reported diagrammatically.

Definite limits have been arrived at for tensile strength, elongation and impact resistance above which all samples must be before acceptance. The strength of the threaded end is important, for it is a lock-nut screwed on to this that keeps the wheel on the car. The strength of the hub ends is regularly "proofed" by screwing the hub to be tested home into a fixed lock-nut and applying a very considerable torque graded to suit the size of the hub, and well up to the maximum ever likely to be applied.

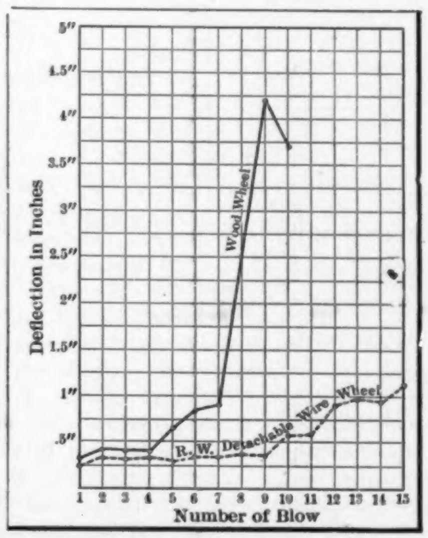


Fig. 10—Diagram showing deflection of various types of wheels subjected to similar blows at different points on the rim

Hub Shells.—These are drawn from sheet steel, and some types are all in one piece. About fourteen drawing operations, each followed by careful annealing, are required. Quite apart from the stresses the hub is subject to in use, this mode of manufacture itself exacts a very special quality of steel, and when it is remembered that a moderately high elastic limit is required in the finished shell to resist the bursting stresses and the pull of the spokes, and that high elastic limit means greater internal stress and the formation of more brittle amorphous constituent during a given

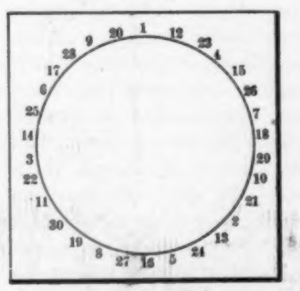


Fig. 10a—Diagram of rim of wheel showing order of blows in above test

draw, it will be understood why the problem of successful manufacture was only solved after a long series of experiments on different steels, followed by the very closest supervision to maintain the uniformity of the steels selected.

Every consignment is analyzed and tested for tensile strength, yield point, elongation, contraction and resistance to impact, not only as received, but after heating under conditions as to time and temperature similar to those obtaining during an annealing operation.

Every consignment is also microscopically examined for flaws, manganese sulphide, size of crystal grains, form of carbide, etc. As would be expected, the behavior in the drawing press is closely related to the elongation and contraction. Much depends also on the distribution of the pearlite and granules of cementite. One with a core rich in pearlite, but with decarbonized surfaces, may give much the same analysis as a steel with granules of cementite uniformly distributed throughout the ferrite, but the results in the press are very different. All reports on steels are typed on squared paper, and include a diagram (Fig. 12) embodying, as far as possible, all the experimental results that affect the mechanical properties. For instance, *AC* represents the tensile strength and *AY* the yield point in pounds per square inch of a sample of motor hub-shell steel, *AB* its breaking elongation and *AF* its contraction per cent. The area *ABC* represents in diagrammatic form the energy required to break one square inch of the steel by tension. Likewise, the area *ABEF* represents the ductility of the steel. *DB* is obtained by dividing the energy in inch pounds per square inch absorbed in breaking by impact, by half the breaking elongation, so *ABD* represents the energy per square inch required to break a test piece 1 inch by 1 inch. The corresponding triangles, etc., on the left, refer to the steel after annealing.

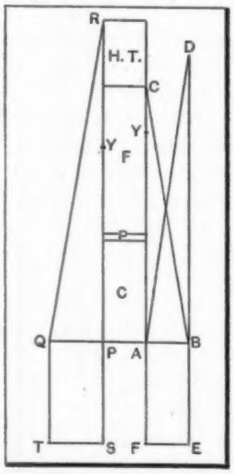


Fig. 12—Diagram embodying experimental results affecting mechanical properties of wire wheels

The rectangular areas, marked *C, P* and *F*, are calculated from the results of analysis, using the formulæ suggested by Campbell (*Journal of the Iron and Steel Institute*, 1904, No. 2, page 21), modified to suit this class of steel. The area *C* represents the part of the tensile strength contributed by the carbon (or more accurately by the carbides and their distribution) and that marked *P* the part due to phosphorus. In this instance the manganese was not present in sufficient quantity to add to the tensile strength. The area marked *F* represents the tensile strength due to ferrite alone in this class of steel, and the rectangle, which is the difference between the observed and calculated tensile strength, represents the portion of the tensile strength added by the heat treatment and annealing.

Not only the hub shell, but also the spoke ring and the withdrawal ring that go to complete the outer hub, are analyzed, tested and microscopically examined in a precisely similar way. To check the correctness of the dimensions chosen for the hub shell, the finished shell was tested under torque, as already described, and under spoke tension—(1) by inserting spokes and putting them in a Denison machine, and (2) by building up into a wheel and steadily increasing the tension (which was measured as described below) until permanent deformation occurred.

To ascertain the resistance of hub shells to impact, wheels built up with experimental shells are tested with the impact pendulum. To check the care with which the annealing is done, tensile tests and analyses are made on pieces cut from the finished shells to see that the carbon is not "burnt off" and that the elastic limit is not lowered.

SPOKES.—Though the great care exercised in choosing and maintaining the quality of hub-shell steel is necessary, still

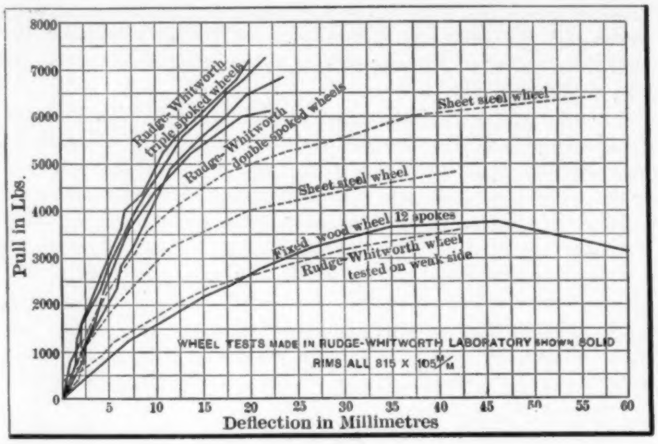


Fig. 7—Diagram showing the deflection under tension of various types of wheels in a testing machine

greater is that necessary in the choice and maintenance of suitable material, structure, dimensions and design for the spokes. This is required because of the variation of tension to which they are subjected. An alternating tension test is used to subject them to variations like those experienced by a spoke in a wheel. In addition to this, all consignments of spokes are tested for tensile strength, elongation and contraction near the head and on the swaged part, and a longitudinal median section is examined microscopically to see if the pearlite grains

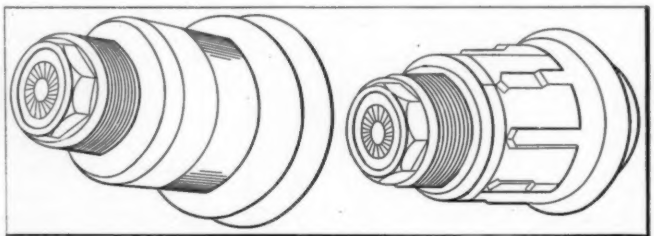


Fig. 11—Inner hub of the Rudge-Whitworth wire wheel

have the dimensions that have been found most suitable. The next slide shows micro-photographs of longitudinal median sections of a motor spoke which did good service in the Isle of Man Tourist Trophy Races, and of a bad motor spoke which broke in use. The microscope also detects undue internal strains set up during heading. Occasional analyses are made.

To check the accuracy of the initial tension on the spokes,

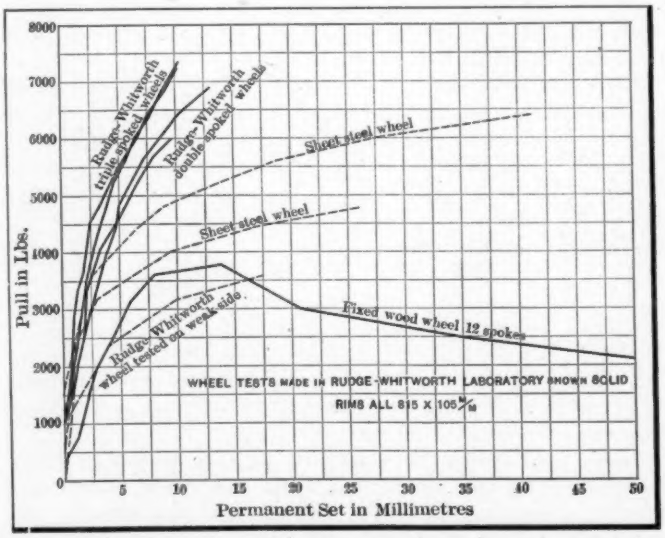


Fig. 7a—Diagram showing the permanent set of various types of wheels after going through the testing machine

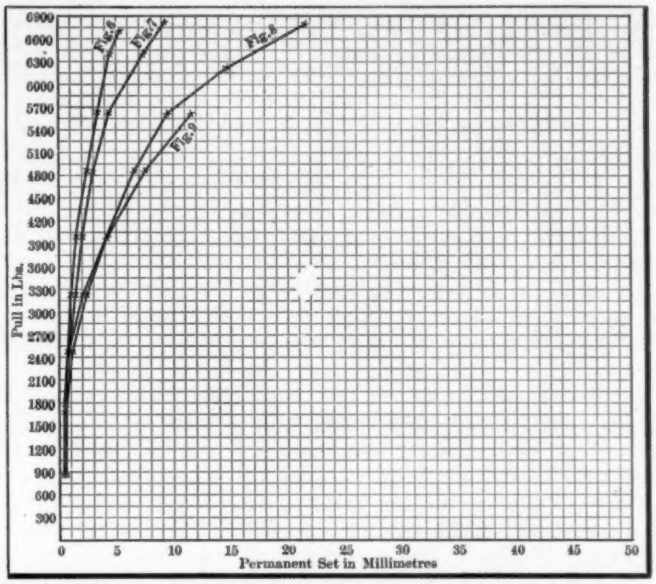


Fig. 8a—Diagram showing the permanent set of the four designs of wire wheels below after testing

wheels are taken at random from the stores and the tension on each spoke is measured. To do this two spokes, one outside and one inside, are fitted into a hub, nipples screwed on, and a pull applied to the nipples in the Denison testing machine. The pitch of the notes emitted at different tensions by the spokes when

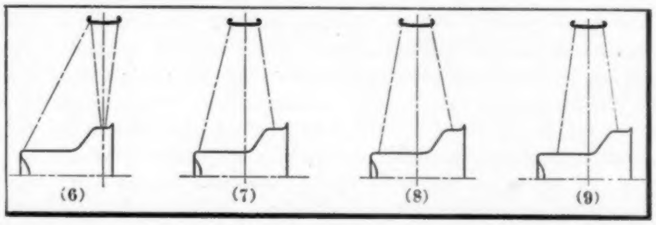


Fig. 8—Cross sections showing the various designs of wire-wheel construction tested

twanged is then compared with whistles and tuning-forks. In this way a scale of tensions is found for each spoke which corresponds to a definite scale of whistle notes. The spokes in the wheels are then twanged, and their pitch—and therefore tension—ascertained by these whistles. The spoking machine

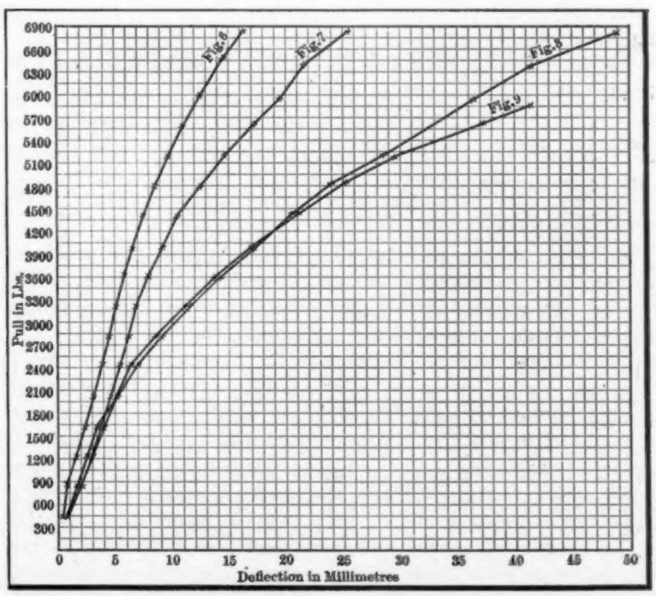


Fig. 8b—Diagram showing the deflection under load of the four designs of wire wheels shown above

now used in building these wheels goes far to insure uniformity of tension. The microscope has proved useful in controlling the spoke threads. The threads on Rudge-Whitworth motor (and cycle) spokes are not cut in, but rolled out of the metal. In this way the diameter and strength obtained at the base of the thread is greater, for the rolling process jumps up the metal, strengthening it by the cold working it gets. With the microscope the actual displacement of the metal can be accurately followed by observing the positions taken up by the pearlite grains and the degree of cold working at various parts of the thread can be gauged. Lines of weakness can be detected at once, as also imperfection in the outline.

Nipples.—The material from which the nipples are made has to be of high tensile strength. Consignments are tested for tensile strength, enlongation and contraction. They are also analyzed and occasionally tested with the impact tester. Of course, nipples and all other parts of these wire wheels have their essential dimensions gauged by a large staff of expert viewers, but as this work—though scientific in so far as "science is measurement"—is really outside the work of the laboratory, it is omitted from the present account.

Rims.—The stresses to which rims are subject are complex. As already pointed out, load bends the rim, flattening it where the load is borne. This varying flexure will spread to the rim bead, making it bend and unbend to a slight degree. Another and more important cause of the bead bending is due to the tendency of the cover to pull away. This is proportional to the air pressure and the radius of the air tube section. For a tire pumped up to 90 pounds per square inch, and with an inner tube 4 inches in diameter, the force on 1 inch of the bead and perpendicular to it will be 180 pounds. This force will vary in magnitude, being greater near the ground and when rounding a corner, and will call into play transverse strains.

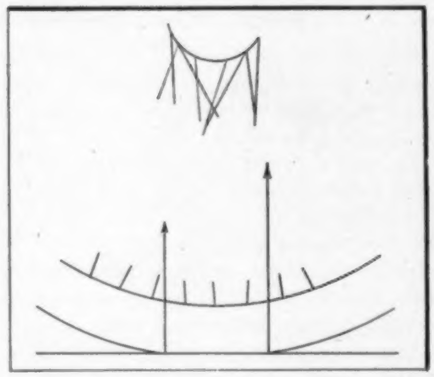


Fig. 13—Demonstration of the effect of elastic hysteresis in tires due to heat and work

In testing rims, therefore, a section 1 inch wide is taken and tested by applying a pull to hooks made to imitate the bead of a motor tire, and the elastic limit and yield point recorded. The tensile strength, elongation and contraction are determined of pieces cut transversely as well as lengthwise, and the rims are occasionally analyzed, tested for resistance to impact and microscopically examined.

Tires—Although tires are somewhat outside the limits indicated by the title, the influence of the wheel on the tire is too close to omit that reference to them. One characterisic feature of wire wheels that contributes to reducing the tire depreciation, viz., power of absorbing shock, has already been mentioned. There are others. The rise of temperature of tires after a quick run is familiar to all. The hand cannot be held on the treads, cold water is converted into clouds of steam and actual measurements on racing car tires (*Automobilia*, August, 1908) show that at 135 kilometers per hour the temperature reached by the cover and air tube were respectively 132° C. and 96° C. This is in part due to friction between the ground and the tire tread just as it is leaving and retouching the ground owing to the inequalities of the road surface, etc., in part to friction in the canvas or fabric and in part (and probably in greater part) to the fact that when the stress in rubber is considerable, and its temperature is a few degrees above 8° C., both extension and compression cause rise of temperature (Todhunter and Pear-

son's "History of Elasticity," vol ii., part 1, page 477). As the temperature of the tire rises the tensile strength of the rubber diminishes, and the energy stored in the rubber and not returned on leaving the ground increases rapidly. This not only leads to further rise in temperature but to further softening, greater elastic hysteresis and to increased resistance to the forward motion of the four wheels. This is easily seen from Fig. 13. From measurements made by the Palmer Tire Company the loss for one tire may be as high as one-half horsepower. The bearing of this on the construction of wheels is that the steel rim, which conducts much of the heat away, is, in the case of a wire wheel, able to leave its heat behind, whereas the wood felloe (which has only one-fourteen-hundredth of the conductivity of steel) insulates the rim of the wood wheel just where cooling is most needed. Bearing in mind that the cost of rubber tires is something like 23 per cent. of that of the raw material used in a 14-horsepower, live-axle motor car, the urgent need for something to mitigate the ccst of their upkeep can readily be grasped.

The cost of tires, including one spare, for such a car varies, of course, but taking it at £40 per set of five, their cost is about 13 per cent. of the finished car. Rudge-Whitworth wire wheels for such a car would cost (not including inner hubs) about £17 10s., 5.8 per cent., and, needless to say, the depreciation due to use is far less on this 5.8 per cent. than on the 13 per cent. due to the tires. Unfortunately, I have no figures comparing the wear of tires on Rudge-Whitworth wire wheels with the wear on other wheels, but the impression that wire wheels really do save the tires is steadily gaining ground among motorists.

Some Other Modern Wheels

The defects and cost of tires have led to a quickening of interest in spring wheels, and many attempts have been made to obtain sufficient resilience by employing springs in place of air enclosed in rubber.

In 1906 a spring wheel contest was held in France. There were thirteen entries, two cars forfeited, and one was put *hors de combat* by an accident while landing at Boulogne. Of the ten that started six depended for their resilience upon the application of rubber, and four used metal springs only. The only three that finished the 1300 miles were of the rubber type; the metallic springs broke down early.

The chief defect in spring wheels, and one that is inherent in the system, is the considerable mass of steel that is required to give the necessary resilience. This is consequent on the numerical value of the elasticity of steel and the high factor of safety necessary under alternating stress.

The greatest amount of energy that can, without permanent set, be absorbed by a spiral spring of solid wire weighing 1 lb. is about 50 foot-lbs. This figure can be doubled by employing a hollow spiral tube with thin walls. A straight wire of spring steel weighing 1 lb. will safely absorb 60 foot-lbs. The shocks due to irregularities and obstacles on the road may reach many thousands of foot-pounds, and since the energy to be absorbed varies as the square of the velocity, it is obvious that for high speeds enclosed air, which will take up a practically unlimited amount of energy, is much more suitable than springs.

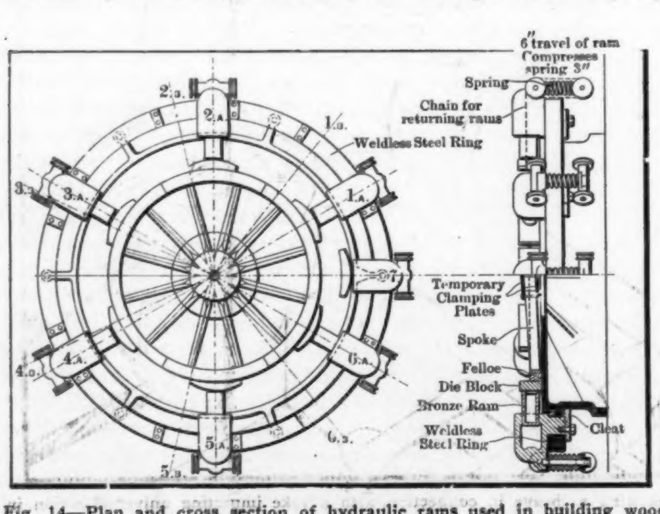


Fig. 14—Plan and cross section of hydraulic rams used in building wood wheels

In the Reid-Reikie spring wheel there are sixty-four spiral springs, each weighing 3 lbs., or nearly 200 lbs. for springs only in each wheel, and each spring has a free radial movement of only about one-quarter inch.

An improved spring wheel capable of transmitting drive to the outer rim was invented by the Hon. R. C. Parsons, and many other types are to be found in the publications of the patent offices.

Railway wagon wheels are now usually made of steel. The flanged tire is rolled from a punched billet and shrunk on to the wheel. This is usually of cast steel, and is forced on a forged-steel axle.

The next slide shows two types of steel wheel made by the Shrewsbury and Challiner Tire Company. These are built up by welding H and T-section girder steel spokes to steel flanges at the center and steel rims by means of the oxy-acetylene blowpipe. When T-section steel is used for the spokes they are arranged on two cones intersecting at the rim. The wheels used on the London Omnibus Company's motor omnibuses are of cast steel.

Thorneycroft truck and traction engine wheels have spokes made of flat steel plates bolted to flanges on the rim. Usually the spokes are on two cones intersecting between the rim and the hub.

The Sankey wheel for motor cars is made of sheet steel and looks much like an artillery wheel. By means of a number of stamping and drawing processes, a plain disc of steel is moulded into the shape of a half wheel. These halves, welded together by oxy-acetylene, form a light wheel, which, as shown by the diagrams of tests exhibited, possesses considerable strength.

Fig. 14 shows a line-drawing of hydraulic rams used for building wood wheels. A wheel-setter, built much on these lines, is used at the Royal Woolwich Arsenal, where the practice is to heat the iron tire, but not to red heat. The degree of compression produced by the contraction of the tire depends on the yield-point of the metal, and this is very low in red-hot iron; consequently, after putting on the hot tires, the rims are used to compress both tire and wheel, the final tightening being performed by the contraction of the rim.

Tire Situation in Germany

The increasing demand in the Kaiser's dominions indicates there is a market there for the product of the American makers. As French and British tires find a market there, it is but fair to assume that a demand for those made in this country could be created with proper trade methods.

EISENACH, Arnstadt and Apolda, in Germany, each maintain extensive automobile manufacturing plants and the output of motor cars and accessories from these factories is growing at a tremendous rate. Naturally, the demand for tires keeps pace. The people residing in the Erfurt region, where the above-named towns are located, know very little about American-made tires, Germany having supplied the bulk up to the present time, although there is one Great Britain firm which keeps a supply of tires in a branch factory in Germany. Tires made in France also go well in this vicinity. Upon the whole, Germany is beginning to demand a higher grade of tires than formerly used. Apolda and Arnstadt manufacture tires principally for small motor cars, the price of which is about $1,000 or less. The touring cars made in the vicinity of Erfurt are especially designed with the view to hard climbing. Heavy tires that will stand up, endure the strain over the mountain highways and not skid are in demand.

Abbreviated Injunctions

Being a series of terse and pointed words of advice to the automobile maker, to the owner and to the man who may contemplate the purchase of a car.

DON'T suffocate a good idea just because it comes from an automobilist who, having experience with one of your make of automobiles, seeing how to make it do better work at a small extra cost, tells you about it; he may be foolish, but he means all right.

DON'T expend $50,000 trying to paint quality in a car that cannot live up to its reputation; it will be more to the point to lavish $10,000 on the character of work that will make the automobile what it is claimed to be.

DON'T try to tell a poor man how to subsist on corned beef and cabbage (he ranks as an expert) nor attempt to place a corned-beef and cabbage automobile on the 1912 market.

DON'T skin; it takes the bark off your reputation; skin-grafting is a slow business at best—why not play fair?

DON'T take every buyer of automobiles for a Sancho Panza—your make of automobile may be a "magnificent entertainment"; the purchaser might prefer a plain car.

DON'T imagine that because you run a beehive of industry the purchaser of your make of automobile will want to emulate the busy bee, fixing the car at every crossroad—take time enough to make a good automobile and charge accordingly.

DON'T preach in favor of a law to compel vaccination for smallpox if you turn out a "deadly infection" that you call an automobile; the distance to eternity is only a certain number of miles in any case.

DON'T penetrate "darkest Africa" looking for ideas to use in your design of automobile; they grow to luxuriance in America; if you don't know where to look for them ask someone!

DON'T deliver abuse if you are so lopsided that you cannot see your way to deliver justice.

DON'T display your ill temper as a substitute for sympathy.

DON'T go to the trouble of making a contract if you propose to be the first to violate its plain provisions.

DON'T appoint as many agents as you sell automobiles; you are making an enemy every time that you make a move if you do it this way.

DON'T slander a man by calling him an agent if all that you desire is to inveigle him into buying one automobile at a discount.

DON'T abuse the agency situation by trying to do business in the sucker agency way—you will be found out and it will go hard with you.

DON'T hire an agent whose only qualification lies in the fact that he may have saved up $500 that you may need to meet your payroll; get a real agent and sell some automobiles.

DON'T gather the impression that you are in the automobile business if you are trading off new for second-hand cars—where do you expect to get off?

DON'T allow your automobiles to accumulate on your hands; there is a market for every one of them if they will run—find the market.

Buy Cars on Installments

The Britishers have evolved a plan whereby those who have not the ready money to buy a car outright may do so piecemeal, enjoying its use meanwhile and meeting all the incidental expenses of its operation.

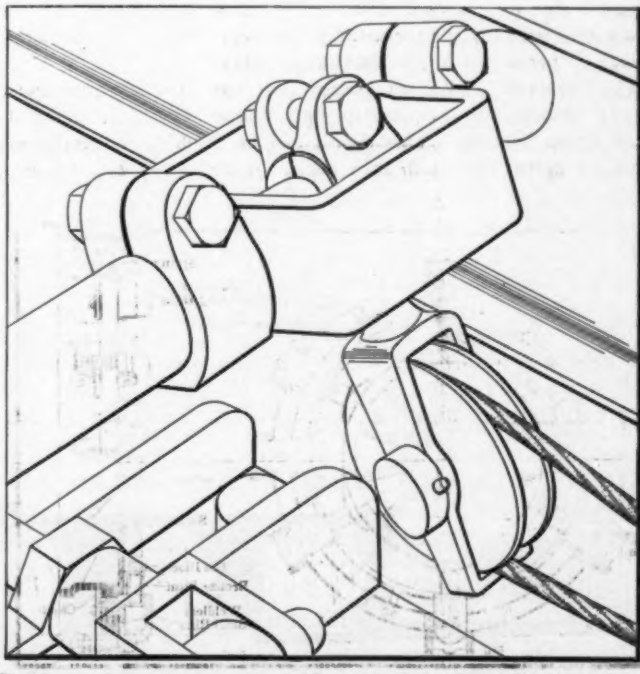
LONDON has solved a problem, by means of which motoring is brought within the means of many men. The plan is for the purchaser to pay £100 quarterly for the period of three years (a total of £1,200), this amount to include all of the running expenses of the car, besides the chauffeur's wages, insurance, petrol, lubricants, tires and repairs. At the end of thirty-six months the car becomes the sole property of the erstwhile renter. The arrangement allows the holder to run the car a distance of 6,000 miles each year. Professional men, doctors in particular, look with great favor upon the scheme. The car intended for purchase on these terms sells outright for £500 ($2,500). Add to this the cost of maintenance, driver's wages, etc., and it will be seen that £1,200 is not far out of the way of the figures involved in the deal.

New Form of Brake Equalizing Mechanism

Owing to the difficulty involved in weighing out the pressure that is to be applied to the respective members of a set of brakes, some form of equalizer is necessary, and the various designers, in coping with this problem, have had to struggle against the inertia of metal masses, and the lack of flexibility that the average mechanism imparts under severe service conditions. A new form of equalizer is here presented.

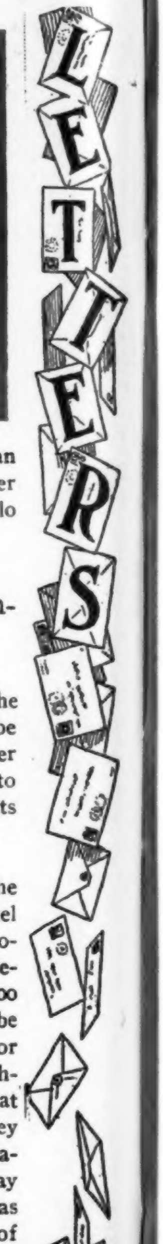
THERE is nothing new about the use of sheaves in conjunction with wire rope in the rigging up of brake-control mechanisms, but the idea of utilizing a pulley block, swiveling in a member that takes its hold at right angles to the plane of the pulley block on the brakeshaft, as shown in the illustration here presented, is a little out of the ordinary, and it offers unusual attractions from two or three points of view. The design of this mechanism is such as to afford universal action, it being the case that the pulley block is free to rotate in its bearing, without interfering with the rotation of the sheave, and the yoke-like member which furnishes the bearing for the pulley block is free to rotate with the shaft. In view of the fact that the yoke-like member is clamped to the brakeshaft, using three clamping bolts for the purpose, a means for ready adjustment, taking up the slack of the cable, is at hand.

If poor relations are persistent, leaky valves and other imperfections are likely to abound in the motor, and nothing remains but to find them and make the necessary corrections.



Showing a sheave in connection with a yoke imparting universal action in the equalizer of a brake control system

What Some Subscribers Want to Know



Steering Gear Is Lacking in Minor Particulars

Editor THE AUTOMOBILE:

[2,637]—I have an old car out of which I have obtained excellent service for three years and in view of its present condition I have decided to make some repairs and keep it on the road for another year. The steering gear, in my judgment, was too unyielding, and it tires me out to drive this car because of the road-shock that is transmitted to the steering wheel. I do not wish to go to great expense in the overhauling of this car, but I would like to overcome this difficulty. Can I get you to come to my assistance?

AMATEUR.

Brooklyn, N. Y.

The probabilities are that your steering gear is dead irreversible, but you can overcome much of this difficulty by having buffer springs placed in the ball joints of the drag-rod not unlike the plan as shown in Fig. 1, in which the springs B and B1 support the abutments, out of which the spherical cavity is formed for the accommodation of the ball A on the end of the steering arm. The shell, which is threaded over the rod, is cut away at S and S1 to accommodate the neck of the steering arm, and the cap C is screwed over the end of the terminal piece. Pressure may be adjusted within limits by the capscrew N1, which is threaded into the cap C, and the lock nut N prevents the capscrew from backing off. If you can, get these rod ends from establishments that make drop-forgings of the class that are used in automobile work.

Use Diplomacy Twice a Day and Water Once

Editor THE AUTOMOBILE:

[2,638]—Will you kindly give me the following information in your next issue? I have just graduated from school and have charge of a 4-cylinder car. My employer likes this car to be kept clean and nice-looking; so do I, because I have very cleanly habits. The car is used for short rides (mostly) morning, noon and evenings. How am I to keep it clean? If the roads are wet and muddy in the morning, and it becomes dirty, how am I to clean it for the afternoon when the roads are nice? If it gets dirty during each trip is it necessary to wash it? Is it best to wash it when putting up at night, or how often is it necessary to wash it? Is it necessary to use soap each time when washing? I notice after washing it with cold water there are spots (greasy looking) on the mudguards. How am I to keep the mudguards clean? Is a good washing all that is necessary? Is there any polish to be used on the mudguards? If so, what kind? I am a willing worker, but I have to care for a pony, furnace, and other jobs, and therefore do not wish to be making extra trouble for myself when cleaning the car. I am willing, and want to keep it clean in the easiest manner.

SUBSCRIBER.

Glen Ridge, N. J.

You know how it is with employers. If they are so fortunate as to get a young man who is willing they are so afraid of losing him that they work overtime trying to keep him in the strait and narrow path. Young men who are willing are lost to employers in two ways. The first way is in the nature of an aging process; like cheese, they get too strong to be tolerated. The second way is a better one. The young man improves with experience, thus making competition among employers, and he goes to the highest bidder, if he has not enough experience, which is generally the case. It would scarcely seem to be desirable to wash the automobile three times per day. The epidermis of the car as it is washed away is not replaced by a continual growth as in the case of the chauffeur's face, so that in the interest of economy it is well to limit the washing of a car to the real necessities. Mud should not be permitted to dry on the surfaces of the automobile. When the car comes home, if it is muddy, a stream of cold water should be turned upon it through a hose from the hydrant, but a nozzle should not be used on the hose. Much pressure with the water will drive the particles of mud into the delicate coat of the car, and dull its appearance. Copious drafts of water will do the work, and after the mud and traces of dirt are removed a chamois skin backed up by "elbow grease" will soon dry and polish the surfaces of the car without damaging its coat or dulling its tint. If it is a mere matter of dust, while it should be taken off before the car goes to bed at night, it is not believed that the automobile should go through three washings a day to remove it. Perhaps a duster, deftly wielded, will suffice on such occasions, but the young man who is willing should not let his employer get the impression that he is trying to do scientific shirking.

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their automobile troubles, stating them briefly, on one side of the paper only, giving as clear a diagnosis as possible in each case, and a sketch, even though it may be rough, for the purpose of aiding the Editor to understand the nature of the difficulty. Each letter will be answered in these columns in the order of its receipt. The name and address of the subscriber must be given, as evidence of good faith.

Too High-Priced to Be Considered

Editor THE AUTOMOBILE:

[2,639]—Please let me know what the power value of hydrogen gas is. Can it be used commercially, and at what price per foot would it be necessary to produce it to make it practical? How many heat units per foot?

A. A. STEWARD.

Rutland, Vt.

There are formidable obstacles in the way of the use of hydrogen gas as a fuel in automobile motors. The fact that hydrogen has 64,400 heat units per pound, whereas carbon has slightly more than 14,000 heat units for the same weight, cannot be regarded as conclusive argument in favor of the hydrogen. A ton of coal is high-priced at $6. We would not like to say that a ton of hydrogen would cost all the money in the world. Beyond these cost considerations there is a reason why hydrogen may not be used in the absence of carbon as fuel in automobile motors. A mixture of hydrogen and oxygen would produce an explosion that would disrupt the motor. The reason for this lies in the fact that the rate of flame travel is far beyond the ability of the piston to get out of the way.

Spring Breakages Pester Unfortunate Owners

Editor THE AUTOMOBILE:

[2,640]—When I purchased my automobile last year I was overburdened with the idea that what I wanted was light construction, an extremely powerful motor, and all the other characteristics which would prevent me from touching the road, excepting once in a while. I met the dealer one fine day last spring, and he agreed

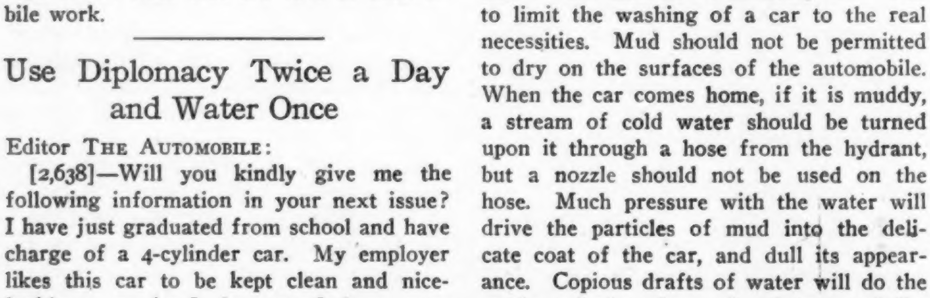


Fig. 1—Cross-section of the terminal member of a drag-rod, showing the use of bumper springs, a means for locking, and a method of adjusting the tension of the springs

What Other Subscribers Have to Say

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their personal experiences for publication in these columns for the worthy purpose of aiding brother automobilists who may be in need of just the information that this process will afford. Communications should be brief, on one side of the paper only, and clearly put, including a rough sketch when it is possible to do so, and the name and address of the writer should be given as evidence of good faith.

with me on every point in sight, showing me the car, which I recognized as mine, beyond the little formality of signing my name to a good-sized piece of paper. Nothing further of a disagreeable nature happened until I went out on the road and promptly broke a spring. When I went back to the agent a mere glance was enough to indicate that he had misplaced his task, and when I showed him the fracture of the springs I was also able to observe that he lost his spectacles. When it came to debate, however, I am bound to say that he beat me out, and as I tore myself away from the place the last question he hurled at me was, "Do you think that we build automobiles to be used in elephant hunting in a jungle?"

I am tired of replacing broken springs, and I want to know what to do about it.

AUTOMOBILE WISE.

Milwaukee, Wis.

You might try moderation in the matter of driving, discriminating a little between good and bad roads, in which event you will probably find that the whole automobile, as well as the springs, will serve you more faithfully. In the meantime, if you have new springs made, add a couple of leaves to the number already used, have them all made of good material, and request the spring maker to hand pien the separate plates to a common radius so that the fiber strain in each plate will be the same, which condition cannot obtain if you replace a couple of broken plates in an old set, as you probably have been doing right along. Referring to Fig. 2, which is a cross-section of a half elliptic spring, at the perch, you will see that a strip of fiber is laid on the perch for the spring to rest upon, and you will observe that split locking washers are used under the nuts of the U-bolts, so that when the springs are clamped to the perches the plates may be pulled down tight against the fiber on the perch, and it is the duty of the locking washers to prevent the U-bolt nuts from backing off. If springs are not held in the tightly clamped relation where they rest on the perches the springs will break. It would not be an impossible thing for you to place a cupped-out metal part between the U-bolts at the point of clamping, and to put a rubber bumper in the cup, so that when the body bounces the springs will be compressed to the limit as fixed by the rubber bumper. The best thing about a bumper lies in the fact that it will serve as a notice to you that you are driving your automobile too fast. Every time the bumper serves notice upon you that it is working, you should slow the car down.

Would It Pay to Remodel a Northern Car?

Editor THE AUTOMOBILE:

[2,641]—I have been a reader of THE AUTOMOBILE for three years, and find many helpful ideas in it; therefore will ask a few questions.

I have a 1906 two-cylinder Northern touring car, five passenger, rated at about 20 horsepower. It is in good running order, but is rather heavy for the power, and has 30 x 4 (1905 style) Dunlop tires.

As it is hard to sell a second-hand car, I thought of remodeling it somewhat, if the cost would not be too near the cost of a new roadster.

1. Would it be possible to remove old touring body and fenders, and put on a light two-passenger torpedo roadster body, and new, up-to-date fenders; also remove old rims and put on Universal rims?

2. Which size would be better, 30 x 4 or 32 x 3 1-2-inch tires? What would be the result of placing the gasoline pipe beside the exhaust pipe to warm gasoline before entering the carbureter?

3. Which will give the best results, warm gasoline or warm air to carbureter?

4. Can I use friction or belt-driven low-tension, direct-current magneto with my present coil and get good results?

Arcadia, O. H. M. L.

If, as you say, the Northern automobile is in good working order, the complaint being that it is too slow for you, which is the interpretation to put upon your statements that the car is a little heavy for the motor, it would seem as though you are the possessor of just the kind of an automobile that would serve for someone who does not care to go fast, and who will not be put out if the body does not check up to the latest and most approved design of torpedo roadster work. You should be able to find someone who will pay you a reasonable sum of money for the car, thus saving you the risk of rebuilding the same, in reference to which it may not be out of place to say:

1. It would be possible to remove the old touring body, fenders, etc., replacing the same by a new torpedo type of roadster body, including fenders. Moreover, the replacing of the clincher rims with quick detachable rims, as far as the wheels are concerned, is a regular and feasible undertaking. Referring now to the body, you will understand that the cost of a torpedo type of body to a maker who is making a large number of cars might be in the neighborhood of $40, whereas were you to go to a maker of bodies and attempt to get one for your old car, you would be charged from $200 to $500, without getting much for your money. It would seem, therefore, as though the amount of money you might be able to realize on your old car, plus the cost of overhauling the same, would be sufficient to enable you to purchase a torpedo type of roadster that would serve your purpose well.

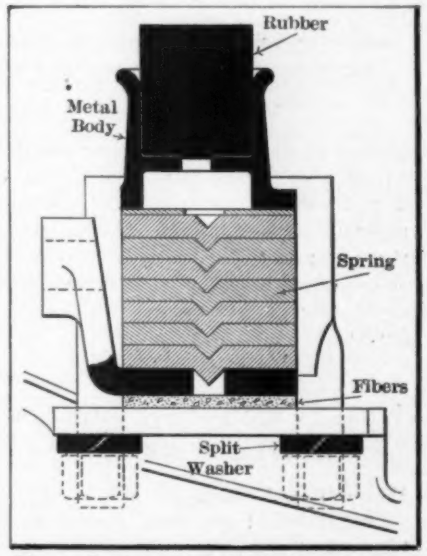


Fig. 2—Section of a half-elliptic spring, at the approach of the spring perch, showing the use of fiber on the perch, stout U-bolts, and a locking device under the nuts, also the application of a rubber bumper

2. Comparing 30 x 4-inch tires with 32 x 3 1-2-inch tires, our preference would be for the latter. Placing the gasoline pipe alongside of the exhaust pipe to keep it warm, as you say, will give you trouble. Gasoline boils at a low temperature, but you do not want boiling gasoline, excepting after it oozes out of the nozzle of the carbureter.

3. Referring to the method of supplying the heat to the gasoline at the instant of evaporation, as it is picked up by the incoming air, it is immaterial how the heat is supplied as long as there is enough of it to equal the latent heat of evaporation of the gasoline. If the air is heated by any suitable means and is then drawn into the depression chamber of the carbureter, experience shows that the results are good. A suitably contrived hot-water jacket for the carbureter accomplishes the same end.

4. It is not certain that you will be able to realize a good result by belt-driving a low-tension magneto and delivering the

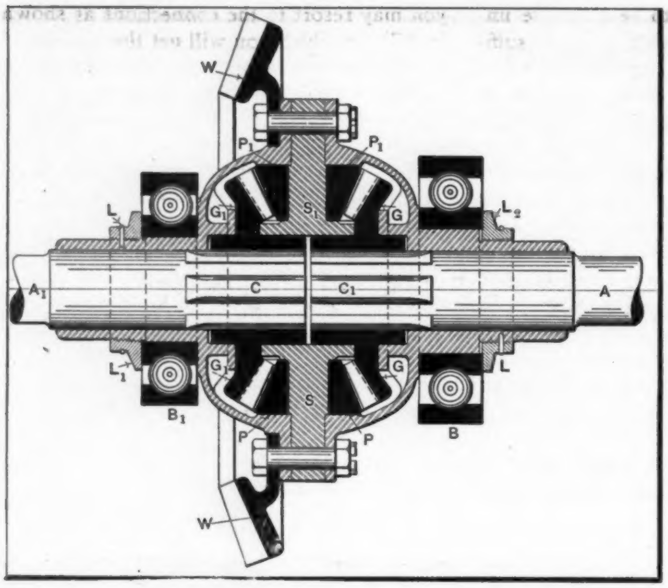


Fig. 3—Section of a bevel type of differential gear mounted on annular type ball bearings with splined terminals of the jackshaft members and other refinements of construction

current from the same to your present coil. There are chances for trouble, not only in your present coil, but in the low-tension magneto as well. This situation suggests that you might spend $700 or $800 in fixing your car, and end up with a machine that could scarcely be described in sanctioned language.

What Is the Proper Function of the Differential Gear?

Editor THE AUTOMOBILE:

[2,642]—As I go about among automobilists and listen to their conversation I am struck with the frequency with which the word "differential gear" is used, but however much I peak into the machinery nowhere can I find anything that looks as the word implies. What is a differential gear? CURIOUS.

Pittsburg, Pa.

Referring to Fig. 3, which is a cross section of a differential gear, its construction may be briefly described as follows: The right rear road wheel of the automobile is fastened to the outer extremity of the jackshaft A, and the left-hand rear wheel of the automobile is fastened to the outer extremity of the jackshaft A_1. Power is supplied from the motor through the change gears by way of the propeller shaft to the bevel gear W, for the driving of the rear road wheels of the automobile, thereby propelling the same along the road. There would be no complication were the automobile required to travel straight ahead, in other words, on a tangent, with never a thought of turning around the corner. But directly the automobile is steered around the corner so that the wheels have to describe the arc of a circle, the differential gear comes into play, due to the fact that the outer road wheels of the automobile must travel a greater distance in a given time than will be made by the inner road wheels of the automobile in the same time.

It is the function of the differential gear to weigh out the power of the motor on an equitable basis to the inner and the outer rear wheels of the automobile, if they are used for driving, as the car describes the arc of a circle in turning around a corner. Referring again to the illustration, it will be seen that the bevel gear W is bolted to the differential housing, and that the housing is mounted on annular-type ball bearings B and B_1, so that when the bevel gear W rotates, the differential housing takes up this rotation. Within the differential housing the bevel pinions, which are centered on the spindles S and S_1, rotate also in unison with the bevel gear W, and the differential housing. These pinions mesh with the bevel gears G and G_1. These gears in turn are splined at C on the shaft A_1 for the gear G_1, and on the opposite side the gear G is splined at C_1 on the shaft A. When the automobile is going straight ahead the differential gears transmit torque, but they do not rotate relative to each other. What happens is that the whole nest of gears, constituting the differential system, rotates as a unit, in unison with the rotation of the bevel gear W. But when the automobile turns around a corner, relative motion is set up in the differential gearset, and the driving road wheels of the automobile are permitted to revolve independent of each other through the compensating ability of the differential gearset. Notwithstanding the fact that there may be a difference in the speed of rotation of the road wheels, thus demanding compensation on the part of the differential gearset, the fact remains that the torque of the motor, in other words, its twisting moment, is weighed out to the respective road wheels in conformity with their needs, and so it may be said that the differential gearset, as it lodges within the enlargement of the live rear axle, is the peacemaker between the disagreeing road wheels under a difficult set of conditions, and among the advantages that are derived by the presence of the differential gear, mention is made of the reduced cost of tire maintenance, which may be directly chargeable to the fact that rolling motion is maintained by the road wheels when the automobile is going around the curve, whereas in the absence of a differential gearset, one of the road wheels would have to drag, and the tires would be damaged, more or less, in the process.

There Are 99 Chances in Favor of This Plan

Editor THE AUTOMOBILE:

[2,643]—As a reader of your journal I take the liberty to ask a question that is of great interest to all the people of San Juan County, N. M.

You will notice by the map that we are situated about 120 miles from the main line of the Santa Fé, and all our freight as well as passenger traffic has to come via Denver over the D. & R. G., which makes it a long and expensive haul for our fruit, which usually goes to the Southern markets.

Do you think it would be wise to try to haul freight and passengers the 120 miles over desert roads, mostly sand, but quite level?

The cost for passengers by railroad is about $25 for railroad ticket alone. Please let me hear from you concerning this.

J. D. HORN.

Aztec, N. M.

It would be a good business risk to undertake the work outlined, using freight automobiles for the purpose. Failure would confront the enterprise (a) if the trucks are not of good design and construction, and (b) if they are made to go too fast.

No Objection to Putting on the New Carbureter

Editor THE AUTOMOBILE:

[2,644]—I have a motor with a bore of 4 1-2 and a stroke of 5 inches, and would like to put a carbureter on it for various reasons. It now has a 1 1-4 inch size on and I would like to change this for a 1 1-2 inch. Would I have to make the diameter of the intake pipe larger? The present intake pipe is now 1 1-4 inches in diameter inside. Would a larger carbureter give me more speed and power? I would also like to know the make of muffler used on the White, Cadillac, National, Chalmers, Marmon and Packard, if it is possible for you to tell me? FRANK ZIMMER.

Cleveland, Ohio.

The fact that you replace the old carbureter with one of slightly greater ability does not require you to put on a new manifold of larger diameter. There is less danger of getting into complication by using a larger carbureter than there would be if you put on a larger manifold. The fact of the matter is that the carbureter can be too small, and the manifold can be too large. The carbureter would show that it is too small if the motor becomes enfeebled along an upgrade pull. From the manifold point of view, backfiring is an indication that it is too large. When the flame travels faster in the direction of the carbureter than the

speed of the mixture toward the motor in the manifold this is a sign that the manifold is too big.

We have not been able to obtain reliable information to answer your last question.

Properly Managed Motors Do Not Back-Kick

Editor THE AUTOMOBILE:

[2,645]—Please state whether or not a valve-in-the-head motor will produce more power than another style of motor of the same bore and stroke, and if so how much?

Will it produce more noise after the first two or three years' use because of its style?

What can be done to get rid of back-kick in my motor?

T. J. HOSKINSON.

Connellsville, Pa.

We are frequently requested to state which of the two types of motors named, considering a given size, under equal conditions of speed, will be the most powerful. It looks like dodging the issue to avoid expressing an opinion, but it would be equally out of the question to state which of two motors of any type as T-head motors, if they are designed under different conditions, would deliver the most power. Experience has shown that the power obtainable from a motor is not settled arbitrarily by fixing the sizes of the cylinders and utilizing mechanisms of one kind or another. The thousand and one influences for or against efficacious thermal relations are paramount and in the long run the way to find out how much power any motor will deliver is to make a proper test. Motors with exposed valve mechanisms will make more noise in the long run than motors of the class that have their mechanisms muffled. This is provided that the motors with exposed mechanisms are not fitted out with means for profuse lubrication.

Retard the spark before cranking to avoid a back-kick.

In the Management of Dry Batteries

Editor THE AUTOMOBILE:

[2,646]—I begin to suspect that the cost of purchasing new dry cells for my ignition system, at an expense of upwards of $5 each time, is in excess of the cost of a good secondary battery, and yet I hesitate to incur the troubles that must come in the direction of recharging the secondary battery every time it is run down. Moreover, I understand that secondary batteries sulphate, if they stand uncharged for some time, as they must in ignition work, and that the life of a battery after it sulphates is but short at best. In the face of discouragement, under the circumstances, I have to believe that there are some points in favor of dry batteries that do not appear on the surface, and while the management of a dry battery seems to be a simple undertaking, it may be that I am not sufficiently well informed to appreciate its fine points, and it occurs to me that you might help me out in this dilemma, just as you have on other occasions, and to my advantage.

IGNITION TROUBLE.

Greenpoint, L. I., N. Y.

The best service may be had from a dry battery, if it is not overworked. If the battery is of sufficient capacity, considering the requirement from the point of view of the spark coil, it remains to maintain a good state of electrical conductivity, and the only way to do for this purpose is to solder all of the joints. One bad joint will increase the electrical resistance of the circuit sufficiently to defeat good service.

Referring to Fig. 4, showing three ways of connecting up the cells of a dry battery, the method (A) is the best one to use, if the cells of battery are sufficiently large as regards capacity to insure that they shall not be overworked, considering that the current is required to work the coil. It is desirable to know the characteristic of the coil in order to understand what will be the best voltage of the battery that is to be connected thereto. If the coil works economically on 6 volts it is more than likely that a minimum of 4 and a maximum of 6 large dry cells will have to be used in a simple series. All considerations of economy are tied up in this question of the voltage required by the coil, comparing it to the voltage available from the cells in series. It is said, in practice, that a dry cell will give 1 1-4 volts; this is probably on open circuit. It is generally safe to figure upon 1 volt when the circuit is closed and the coil is taking current, if the number of cells in series is sufficient to deliver current to the coil at the voltage of the best economy.

If the characteristic of the coil is not to be had it is recommended that 5 cells be placed in series, as a compromise measure, but if the life of the battery seems to be too short, owing to the use of small cells, or to the piggishness of the coil, the next plan is to take 5 cells, a, b, c, d and e, and connect them as in (A) with the carbon of a to the zinc of b, the carbon of b to the zinc of c, the carbon of c to the zinc of d, and the carbon of d to the zinc of e. Having thus proceeded, connect up the second set of 5 cells in precisely the same way, and then cross-connect the two sets in the manner as shown in (B) so that the zinc of a will be connected to the zinc of f and the carbon of e will be connected to the carbon of j. By thus connecting two sets of 5 cells each in series multiple, you will obtain the voltage of 5 cells and the current-giving capacity of two sets of 5 cells each.

Should you find that this system is difficult to keep in good balance, it being the case that a dead cell will give trouble, and that compensation between cells is somewhat difficult under the conditions of (B), you may resort to the connections as shown in (C), in which you will get the voltage of 5 cells in series, and the current-giving ability of two sets of 5 cells in series, with the further advantage that compensation between cells will be more certain, owing to the cross-connections in compound series as shown in (C), wherein the cells af are connected from zinc to zinc and from carbon to carbon, and in the same way the cells bg, ch, di, and ej, are connected. The external circuit is between the zinc of af and the carbon of ej, thus giving the voltage of 5 cells, and the current-giving capacity of two sets of 5 cells. In the compound series method of connecting up, however, if one cell dies it does not put 5 cells out of action, which is true in the preceding examples.

Which Is the Faster, Automobile or Motorcycle?

Editor THE AUTOMOBILE:

[2,647]—Which is the faster up to Feb. 1, 1911, the motor car or the motorcycle? I do not care whether or not the time is official, just so there is no question about its having been made.

We have Oldfield's mile in 27:33 (car) and Curtiss' mile in 26 3-5 (cycle), also Jenatzy's kilometer in 16 seconds (car). Are the above correct?

SUBSCRIBER.

Sleepy Eye, Minn.

The fastest time made on an automobile before February 1 is that of Jenatzy, turning the kilometer in 16 4-5, making his time 133.1 miles per hour. The fastest mile, flying start, on a motorcycle was made by Seymour on October 29, 1910, at Los Angeles, Cal. Time was 41 2-5, and speed 86.9 miles per hour.

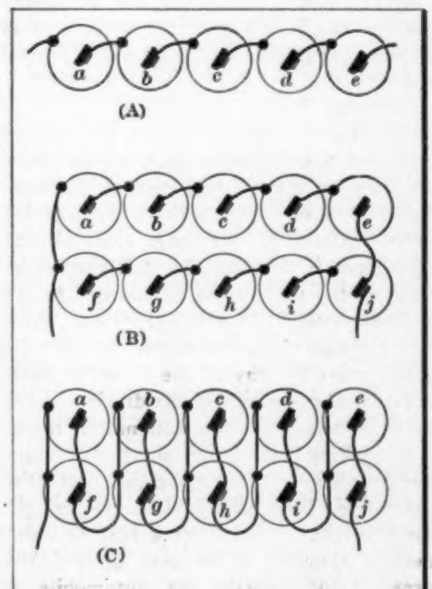


Fig. 4—(A) showing five cells of battery connected in simple series; (B) showing a series multiple connection of two sets of five cells; (C) giving compound series connections of two sets of five cells of battery

In the Hardening of Steel

How to Get the Most Service from Material

E. F. Lake tells the story of the hardening of steel, illustrating the several conditions by means of photo-micrographs, presenting, in tabular form, the datum of the materials, and relating in simple language the relevant facts that the manipulator must take cognizance of to obtain the best results.

AS there are so many parts in the makeup of an automobile that give much better results when made of steel that has been hardened, it will probably be well to go into the principles of hardening steel and trace their effects. The hardening that alters and improves the static strength and dynamic qualities of steel to obtain better results for motor car parts is the only kind we will treat of in this article. While hardening steel for cutting tools is very important, it has no bearing on this subject.

In the latter case the carbon content must be above 0.30 per cent. or the metal cannot be made to assume a hardness that will give it a good cutting edge. In the first case, however, a greater tensile strength, elastic limit, etc., or better wearing qualities may be obtained from steels of any carbon content whether above or below 0.30 per cent. This is more graphically shown in Table 1 in which the chemical composition and static strengths are given of 6 steels with different carbon contents, in both the annealed and hardened condition.

To give steel any degree of hardness it is necessary, in theory, to raise its temperature to the highest point of transformation, hold it there long enough for the grain structure of the entire mass to assume its new form and then instantaneously cool the metal to atmospheric temperature. This will hold the new-born grain structure in the form it has assumed. In practice it is necessary to raise the temperature a few degrees above the highest recalescent point to allow for that lost in passing the steel from the furnace to the quenching bath, and also allow for the slow cooling when in the quenching bath.

The principle on which hardening property is based is that a grain of iron carbide and one of pure iron lie side by side disunited. Annealing has caused this separation, which is only microscopical, to take place between them, but they still lie so close together that they can easily be united. Heating the metal to just above the highest recalescent point causes them to combine and this unity can be made permanent by suddenly cooling the steel from this high temperature. This union causes steel to show a substance of a filmy nature when microscopically examined. This is a new constituent that has been born. It is called martensite and hardenite.

Martensite is discovered from lines intersecting each other in the direction of the sides of an equilateral triangle, as shown in Fig. 1. It is the principal constituent of all ordinary hardened steels with a carbon content above 0.16 per cent., and tempered steels owe it their quality of hardness. An 0.85 per cent. carbon steel heated to 1400 degrees F. and suddenly quenched will show the martensite very pronounced. It is so hard a needle will not scratch it. When more than 0.85 per cent. of carbon is present the martensite is said to be saturated and shows slightly different under the microscope. In that condition it is often called hardenite.

When the rate of cooling is not as rapid as that produced by quenching, but is still much faster than the slow cooling of annealing, another constituent, called sorbite, is produced. This can be obtained by quenching immediately below, or just at the end of cooling through the critical range, by cooling pretty fast through the critical range without actual quenching, or by rapidly cooling the steel and then reheating to about 1100 degrees Fahrenheit.

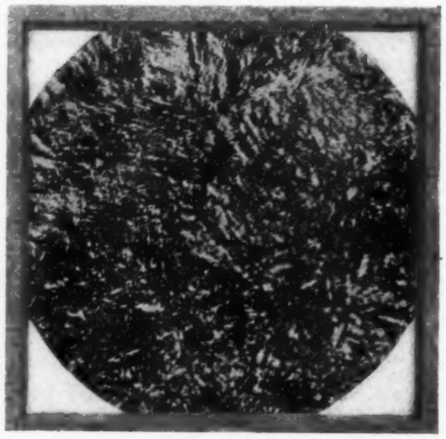


Fig. 1—Condition recognized as martensite as it abounds in hardened steel, magnified 250 diameters

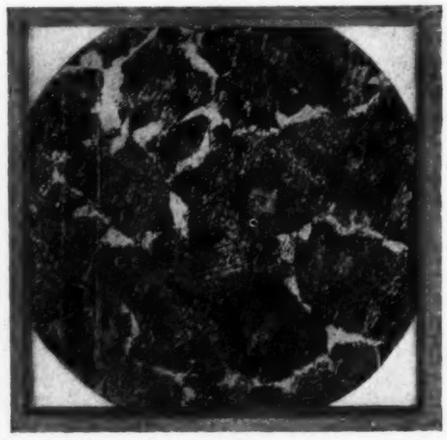


Fig. 2—Ferrite and sorbite in hardened steel, magnified 250 diameters

Sorbite is not clearly defined in micro-photographs but Fig. 2 shows it fairly well in the presence of ferrite. Sorbite is a constituent between cementite and pearlite and chiefly differs by the crystals of these segregating and not quite perfectly developing. The sorbite structure is finer than the pearlite and it is considered the extreme opposite of the crystalline structure. In hardening steel it is considered as the transition from cementite to martensite, and is necessary in steels that must resist wear and erosion. It is possible to produce a natural sorbitic formation by the addition of certain alloying elements to steel.

Steels that contain over 1.10 per cent. of carbon and are suddenly cooled from a temperature of 2,000 degrees F. will, in addition to martensite, show a constituent that may be distinguished from it by a different color. After etching with a 10 per cent. solution of hydrofluoric acid or nitrate of ammonia it will show white. This constituent is softer than martensite and is easily scratched with a needle. It is a conglomeration of ferrite and cementite and has been named austenite.

It is difficult to preserve austenite throughout the whole structure of the steel. If the metal is quenched in a bath below the freezing point, or by other means that will cool it rapidly, it will show more pronounced. Tempering the metal afterward loosens the austenite and thus it is difficult to find in steels that have been heat-treated for commercial purposes. It is not of much practical use, owing to the high temperature at which it is obtained. It is seen in Fig. 3 where it shows in form of white portions among black martensite and troostite formations.

When steel is quenched at, or just above, its highest recalescent point in a bath of little activity, such as oil, we obtain a constituent called troostite. Troostite will show jet black if polished and etched with picric acid. If etched with tincture of iodine it will show white. It can also be obtained by hardened steel in the usual way and then tempering it. It is softer than martensite and can be scratched with a needle. It holds some ferrite, austenite and cementite, or a combination of these. It is readily found in most tempered steels, as it is a product of the usual tempering operations. It shades gradually into the sorbite, but is very sharp in its divisions from martensite.

By submitting steel to different heat-treatments we can change the constituents from pearlite to martensite or hardenite, sorbite, austenite and troostite and back again through these different stages without in any way changing its chemical composition. By microscopical examination it is possible to closely judge the heat treatment to which steel has been subjected. The different constituents indicate the change made in the constitution of the steel, that is the static strengths and dynamic properties that have been altered. It is here that the automobile engineer or designer can practically apply this knowledge, as with it he can design the different parts, whether they be moving or stationary, so that he will get the best results with the smallest quantity of material. The constitution of a given steel is not the same in the hardened that it is in the normal state. In the annealed or normal steel the carbon is in a free state, while in hardened steel it is in a state of solution, which we may call martensite. This contains more or less carbon, according to the original carbon content. The mechanical properties depend principally upon the carbon content and they are changed slowly by an increase in carbon.

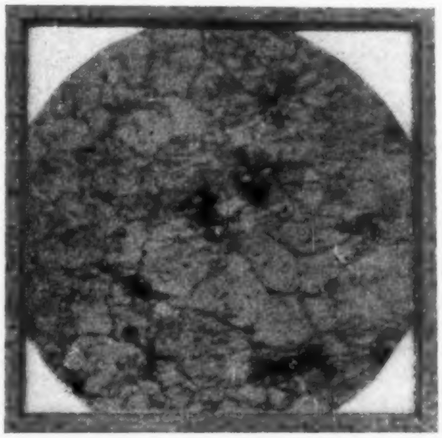


Fig. 3—Austenite, showing white, with a black network of martensite and troostite showing as black patches

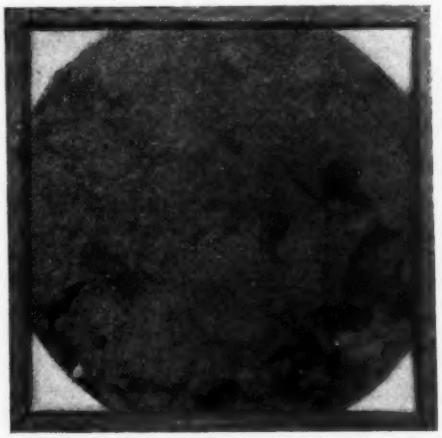


Fig. 4—Martensite, showing white and troostite black in hardened steel

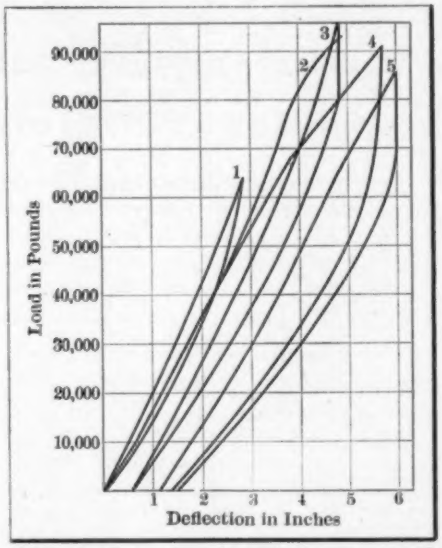


Chart 1—Test of springs that were properly tempered

The automobile builder needs to find a hardening process that will make a steel as homogeneous as possible. In a steel containing 0.85 per cent. of carbon this is easily obtained by passing the upper recalescent point before quenching. The degrees of temperature that this point can be passed and still get good results are very few.

In examining steels that have been quenched above this point we find that the higher we go the coarser will be the martensite, and the lines will be more visible. If we raise the temperature a few hundred degrees above and quench in a very cold bath, austenite makes its appearance. As the martensite coarsens, the tensile strength and elongation are proportionately reduced until they become nil. The reduction of area also lessens. It has been demonstrated that 40 degrees above the highest point of recalescence is the extreme limit to which steel can be raised to obtain the best results in hardening as well as in annealing.

To sum up, we might say, all steels may be hardened, but when the carbon content is over 0.30 per cent. the effect is more pronounced; hardening increases the tensile strength and elastic limit and reduces the elongation, the effect being greater the greater the carbon content; quenching at the proper temperature gives the metal greater homogeneity and aids to its resistance to shock, especially in the low carbon steels; the temperature to which steel should be raised for hardening should not be more than 40 degrees above its highest transformation point, as beyond that it no longer has the same qualities.

The Trend of Events—

Points to the prolonging of the life of automobiles through the more liberal use of good lubricating oil, remembering that the oil must reach the journal to be of any use.

Points to the careful selection of the lubricating oil, remembering that it is good oil, and good oil only, that should be allowed to come into contact with the polished surfaces of the ball and roller bearings.

TABLE I.—INCREASE IN STRENGTH CAUSED BY HARDENING.

Chemical Analyses.					Static Strength When Annealed.			Static Strength After Hardening.			Increase in Strength.			
					Pounds per Sq. In.		Elongation in 2 Inches.	Pounds per Sq. In.		Elongation in 2 Inches.	Pounds per Sq. In.		Percentage.	
Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Tensile Strength.	Elastic Limit.		Tensile Strength.	Elastic Limit.		Tensile Strength.	Elastic Limit.	Tensile Strength	Elastic Limit.
0.10	0.19	0.09	0.03	0.02	60,300	36,300	29	66,400	40,300	24	6,100	4,000	10	11
0.14	0.33	0.05	0.05	0.03	61,500	35,200	27	73,100	39,600	22	11,600	4,400	17	12
0.23	0.45	0.15	0.06	0.09	66,500	41,200	26	99,400	54,000	14	32,900	12,800	49	31
0.52	0.35	0.18	0.04	0.02	97,800	52,600	20	132,100	81,400	9	34,300	28.800	35	55
0.60	0.40	0.10	0.03	0.03	116,400	66,500	14	153,400	102,100	4	37,000	35,600	30	53
0.72	0.38	0.17	0.06	0.03	130,700	75,800	9	180,100	105,500	0	49,400	29.700	38	39

Meeting Recurring Troubles

Presenting a Series of the Most Probable Cases

A series of co-related short stories, accompanied by diagrams and characteristic illustrations, indicating the nature of the troubles that are most likely to happen to automobiles, discussing their causes and effects, all for the purpose of arriving at a remedy. It is the aim, for the most part, to show how these troubles may be permanently remedied, and as a secondary enterprise it is indicated how the automobilist can make a temporary repair, thereby enabling him to defer the making of a permanent repair until a convenient time arrives.

When the Motor is New—Flexibility of performance of a new motor is interfered with on account of the binding of the bearings throughout, which condition is to be alleviated by operating the motor in relatively light service, supplying a surplus of good oil, and awaiting the time when the bearings are "run in." How long it will take to reduce the bearings to their best level depends upon how well the motor is assembled in the first place, also upon the harmony of relation of the members, which is a matter of design. During the early performance of a motor, while the bearings are being run in, even under conditions of excess lubrication, the bearing surfaces wear down a little, and the lubricating oil becomes contaminated by the particles of bearing metal that are torn off, and such other matter as may be left in the motor after it is assembled and tuned up by the maker. The first duty of the automobilist after the motor is run in is to remove all of the lubricating oil from every part, clean out the cavities at all points, and then replenish the supply of lubricating oil, making sure of the quality of the same.

If the New Motor Performs Badly—Granting that the bearings shoulder their part of the responsibility during the period of the "try-out," but that the power of the motor is lacking, it suggests that troubles may be due (a) to a poor mixture, (b) inferior ignition work, and (c) loss of compression. If the mixture is bad, the carbureter must be fixed, and if the ignition system fails, it too must get attention. Coming down to the motor, as referred to in (c), reference is made to Fig. 1, which is a section of a cylinder through a valve, showing the relation of the water-jacketing to the heated surfaces within, and the location of the valves of the bevel-seat type with its stem running in a water-jacketed guide and the valve held to its seat by means of a spring. Above the valve in the cylinder a plug is screwed in, and the head of the plug is flanged over in order that it will press on the gasket which is shown, when the plug is screwed in tight. The spark plug is threaded into the body of the valve cover or plug, and in this illustration there are four opportunities for leakage presented as follows: (a) by the piston if the piston rings are not tight; (b) by the valve if it does not hold to a tight seat; (c) around the spark plug if it is not screwed in tight, or if the plug itself leaks, and (d) by the valve cover or plug if it is not screwed down tight on the gasket, or if the gasket is of poor quality or improperly placed. Remembering that there are two valves to each cylinder, it will occur to the observing reader that the leakage possibilities above referred to are doubled thereby. In addition to possible leakage from these sources, there is a plug in the head of the cylinder in most examples, and leakage around this plug is an equal menace. Should there be any other leak in the cylinder of a motor it must be on account of defective castings. If leakage is to be suppressed, it is first necessary to locate the offending member, and to make the joint tight in one of the obvious ways is the remaining necessity.

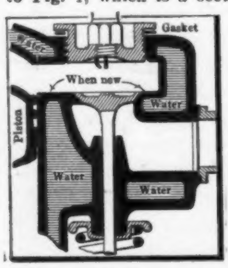


Fig. 1—Section of a motor cylinder showing the condition of the valve seats when the motor is new.

Chronic Trouble Follows Repeated Valve Grindings—The extent to which valves have to be ground in depends upon (a) the character of the metal around the seat of the valve in the cylinder; (b) the character of the metal of the valve; (c) the shape of the valve; (d) the effectiveness of the water-jacketing, and (e) the strength of the valve spring. Discussing these possibilities categorically beginning with (a), assuming that the cylinders are made of gray iron and that the seats are free from imperfections due to "sullage," whether or not the seat will quickly erode, due to the wearing effect of the mixture, which is highly heated on the exhaust side, carrying some solid matter, can only be told, as a rule, after some service. If the metal in the seat is not of equal hardness all around, the softer portion will wear down quicker, and the part having white iron in its composition will stand out, and the valve will then have to be ground in order to reduce the high spots and prevent the leakage. Fig. 2 shows the result of repeated grindings, ending in the sinking of the valve into the metal of the cylinder below the initial position as shown in Fig. 1, and the time must arrive, under such conditions, when the shoulder so formed, having a sharp edge, will produce a condition of pre-ignition, due to the fact that the metal forming the sharp edge will heat up and become the source of ignition. In addition to this trouble there is the chance that a pocket will be uncovered in the body of the metal under the initial surface in the seat, it being the case that in the cooling of cylinders during the casting process shrinkage holes abound in the walls adjacent to accumulations of metal joined thereto. In the particular example, as shown in Fig. 2, the walls around the seat of the valve are quite uniform, and the chances of uncovering shrinkage holes are remote, so that the remaining possible trouble will be due to the grinding away of the walls forming the seat to a point where they will become too thin to sustain under the pressure to which they are subjected in service. The motor will show by cranky performance that pre-ignition is threatened; this condition will come when the motor is propelling the automobile up a long, slow grade, or when the road is heavy, especially if the ignition is retarded. If the motor is shut down at such a time, and an attempt is made to start it in its heated condition, it will back-kick. Should the automobilist make an exploration, discovering that there is a sharp edge of metal formed around the valve seat due to repeated grindings, it will remain for him to refinish the seat of the valve for the purpose of removing the irregularities, and this work must be done before good service can be expected from the motor. Fig. 3 is a further illustration of the idea as brought out in Fig. 2, and the parts of the metal that are likely to overheat and cause pre-ignition are suitably identified.

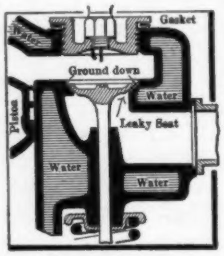


Fig. 2—Section of a motor cylinder depicting the condition of the valve seat when the motor is old.

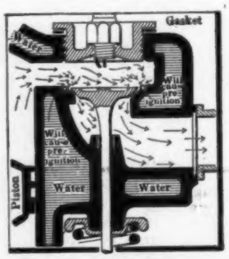


Fig. 3—Section of a motor cylinder showing the fins which will cause pre-ignition if the valve seats are not refaced.

Dangers Encountered in Reseating Valves—Experience has shown that pre-ignition will occur in a motor if some part of the metal heats to a point somewhat above 600 degrees Fahrenheit despite the fact that the major portion of the metal is properly cooled. Under normal conditions a small zone in the center of the piston head is the most likely to cause pre-ignition trouble, and in a motor that has been operated for some time this will be a sign of incrustation, either within the combustion chamber or upon the water-washed surfaces of the dome of the cylinder. If the heat cannot get out, once it penetrates the flame-swept surfaces of the metal of the cylinder it will pile up and there will be a sympathetic transfer of heat from the highly heated walls of the cylinder to the un-waterjacketed head of the piston, and it is not unreasonable to expect that a small zone in the middle of the piston head will reach a dull red heat, in which event pre-ignition, if the compression is above 40 pounds per square inch, is bound to happen. If the motor is clean, and pre-ignition occurs, it will be a wise precaution to unscrew the valve covers as shown in Fig. 4, and if the valve has burrowed into the metal of the seat sufficiently to form a sharp edge, to chamfer the seat down in each case, for the purpose of removing the ridge, is the proper course.

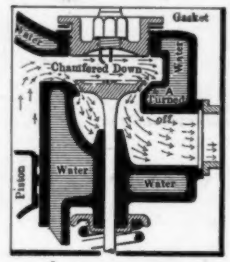


Fig. 4—Section of a motor cylinder after the valve seats are refaced to remove projecting fins.

Pre-Ignition Due to Inferior Design—If pre-ignition comes in a new motor, it is a moral certainty that there is a fault of design to be overcome. Fig. 5 illustrates a condition that would produce pre-ignition in the form of a projecting sharp edge around the boss forming the seat of the valve. In some motors the valve seat is reinforced by a boss that is made by putting a loose piece on the pattern when it goes into the sand in the foundry, and this loose piece is likely to shift, or float out of place during the pouring of the metal, so that in the finishing of the valve seat, when the motor is being made, the projection is left and the sharp edges of the thinned-out metal remain. In other cases, if the cylinders are cast with the pattern lying horizontal, the parting line comes in such a place that the "chipper" is unable to remove the raised seam, and in the finishing of the cylinders this seam comes at the upper end of the stroke at the joint of the combustion chamber so that it is not tooled out all around, and this raised seam will cause pre-ignition, due to the heating of the thinned portion of raised metal. In a very high compression motor this trouble will be pronounced, but as the compression is reduced, the trouble will be less in evidence, although it will grow as the motor accumulates carbon within the combustion chamber, and scale is formed on the exterior dome of the cylinder. The proper remedy is to remove the cylinders from the motor once this trouble is suspected, and by hook or by crook chisel off the protuberances, since they must be gotten rid of before the motor will perform satisfactorily.

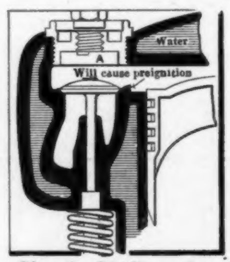


Fig. 5—Section of a motor cylinder showing a projecting fin around the valve seat such as will cause pre-ignition

Soft or Hard Performance Depends Upon Compression—A soft performing motor is one that has a flat characteristic; in other words, the power does not increase in direct proportion to speed, and when the automobile is being accelerated it gets under way lazily, due to the fact that the motor is relatively lacking in vigor. A hard performing motor, on the other hand, is snappy, the automobile is accelerated smartly, but this type of motor stalls readily. The hard performing motor has a peaked characteristic; the power increases in direct proportion to speed up to a certain point, beyond which the power rapidly diminishes with further increases in speed. The soft performing motor has a low initial compression, but it holds this compression over a considerable range of speed, after which the compression dies down at a relatively slow rate. The hard performing motor has a high compression, and the rate of falling off of the compression is lower than the rate of increase of speed, if the power increases as the speed, up to a certain point, after which the compression crashes down, and the motor stalls. Fig. 6 shows the section of a cylinder of a motor that was designed for a high compression, and when the motor was put into service it was found that the compression was a little too high, thus making the motor a cranky performer in ordinary service, suggesting the idea that it would perform valiantly in racing work. To correct this evil from the ordinary service point of view, the valve caps were designed, leaving a cavity in them whereby the compression space was increased. In practice the compression is increased if the compression space is decreased,

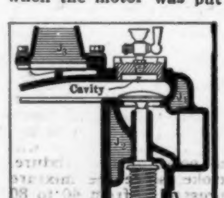


Fig. 6—Section of a motor cylinder showing a noise cavity formed in the valve cover, initially to relieve compression

and the reverse holds if it is desired to decrease the compression—the compression space must be increased. As a general proposition the compression in automobile motors varies between 40 and 80 pounds per square inch, measured by the gauge: (a) 40 pounds (gauge) in two-cycle air-cooled motors; (b) 50 pounds (gauge) in some four-cycle air-cooled motors; (c) 60 pounds (gauge) in excellent designs of air-cooled motors; (d) 70 pounds (gauge) as a general proposition in touring motors, either natural or water-cooled, and (e) 80 pounds (gauge) in motors as they are intended for racing work. It will be remembered that the gauge pressure is 14.7 pounds above the absolute pressure, it being the case that gauges measure pressures above the atmosphere, and the pressure of the atmosphere is 14.7 pounds as measured at the sea level, which absolute pressure decreases with altitude, but not sufficiently from the point of view of the automobile motor to seriously affect performance.

Strange Noises Abide in Motors—Noise with safety and noise that suggests danger belong to different families. Both types of noises are objectionable to the automobilist. The noise that carries with it the suggestion of danger may be fixed by the repairman in the ordinary way, if he is skilled in the art; but the noise that taxes the ingenuity of the searcher, which persists after the repairman gets through with his work, will generally be found to be due to some structural peculiarity of the motor, or some change in the relation of the members of the same, the character of which does not interfere with the mechanical performance of the automobile. Fig. 7 shows the section of a cylinder with a priming cock C1 placed in the valve cover, leaving a cavity C2, due to the fact that the valve cover is relatively thick and the threaded portion of the cock is shorter than the distance through the section of the cover. The cavity so formed is likely to produce a strange whistling noise, and the idea is suggested that lack of symmetry of the cylinder walls is the seat of a type of noise that will test the acumen of the repairman, and put the owner of the automobile on edge.

Profuse Cylinder Lubrication Has Its Disadvantages—When a motor is new and it is being run in lubrication should be maintained so that the motor will smoke a little all of the time, but after the motor has reached its working level and its sweet-running qualities are induced in the fullest measure, the quantity of lubricant fed to the cylinders should be pinched off, so that the exhaust will show no sign of burnt lubricating oil. Fouling the spark plugs is one of the serious difficulties attending excess lubrication, and if the spark plugs are placed horizontally, as shown in Fig. 8, the chances of fouling are somewhat increased, due to the fact that the lubricating oil, if it is present in sufficient quantity, splashes into the cavity of the spark plug, filling the air around the petticoat of the insulator, after which the insulation breaks down, and the spark plug then ceases to be of value. When the spark plugs are placed vertically in the dome of the cylinder, the lubricating oil drains out, runs down the central electrode, and drops off into space. Under these conditions spark plugs are self-cleaning. It may be an advantage to have the spark plugs placed horizontally, for then the operator of the motor will be compelled to regulate the supply of lubricating oil to save himself the trouble of taking the spark plugs out at frequent intervals for the purpose of cleaning them.

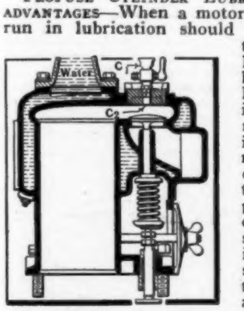


Fig. 7—Section of motor cylinder showing a noise cavity, due to a short threaded part of the priming cock in the cover

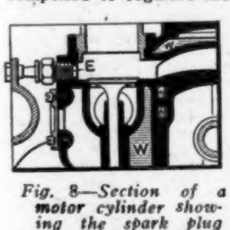


Fig. 8—Section of a motor cylinder showing the spark plug placed horizontally in the valve chamber

When Water Leaks into the Combustion Chamber—In a four-cycle motor the cycles run (a) suction, (b) compression, (c) power and (d) scavenging stroke. During the suction stroke a vacuum is created in the combustion chamber, so that if there is a leak between the combustion chamber and the water jacket, water will be sucked into the combustion chamber and its presence will be sufficient to destroy the poise of the mixture. During the compression stroke, since the mixture within the cylinder is compressed to from 40 to 80 pounds per square inch, depending upon the design of the motor, it will be forced through the flaw into the water jacket of the motor. During the power stroke, considering the average motor, allowing that the piston rings are tight, and that there is no leak from any other quarter that falls to the usual expectation, since the pressure during inflammation runs up to nearly 300 pounds per square inch, power will be lost at an enormous rate. During the scavenging stroke the products of combustion are gotten rid of, and if there is any water in the cylinder as the result of a leak from the water jacket, it will go out in the train of the products of combustion in the form of steam. Unfortunately, a very trifling leak between the water jacket and the combustion chamber will shut down the motor. Fig. 9 shows the top of the cylinder with a cover at the extremity over the combustion chamber, and a second cover over the waterjacket. The outer cover screws into the wall of the water-jacket and is made tight by pressing against a copper-faced asbestos gasket. A stud is threaded through the outer cover, and the end of the stud engages a cavity in the combustion chamber cover, so that when the stud is screwed in it presses against the combustion chamber cover, and, by means of a copper-faced asbestos gasket around the seat, formed out of the dome of the cylinder, the cover is set down tight. A defect in the gasket, or failure to set up on the stud, will result in a leak, and disastrously affect the good performance of the motor. This illustration shows but one of the many plans that are in vogue in motor designing, but the principle of maintaining tightness of the combustion space within the cylinder, so that there will be no leakage to or from the waterjacket, is clearly brought out, and the automobilist who has a mysterious form of trouble with his motor should examine into this phase of the operating problem and find out whether or not the covers are tight.

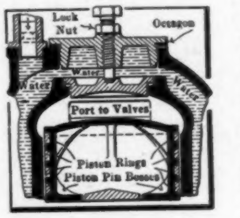


Fig. 9—Section of a motor cylinder showing a cover on the dome of a cylinder and the means afforded to make it tight

Wheezing May Be Readily Distinguished from Other Noises—A serious source of motor trouble is suggested by the word "wheezing" and one of the most troublesome difficulties is depicted in Fig. 10 in connection with the character of wheezing that points to a valve that is not seating on time, or that may not seat at all. If the valve stem is offset, throwing the plane of the tappet out of the plane of the stem, the valve is lifted against the pressure of the spring by contact with the foot of the tappet under the exertion of the cam as it presses on the other extremity of the tappet. Owing to this offsetting relation, the tappet is likely to bind in its guide, and if the condition of lubrication is imperfect the bearing in the guide will run dry, and the tappet will stick, leaving the valve open despite the pressure of the spring. If a small spring is used to pull the tappet back against the cam, it should save this trouble, unless the small spring becomes weakened, assuming that it is small enough in the first place. A grease cup, so placed as to lubricate the guide bearing and prevent the tappet from running dry, will be a step in the right direction. The strength of the tappet spring should also be looked after.

Escape of Lubricating Oil Must Be Stopped—The mere fact that good grades of lubricating oil cost from 45 cents per gallon in barrel lots to 80 cents per gallon in tin packages is one reason for preventing wastage, but the main reason for utilizing this product is to take advantage of its slippery qualities, and in lubricating the crankshaft, if it is done by "splash," the difference between a condition of profuse lubrication and failure lies in the shifting of the level of the oil in the lower half of the crankcase from the working level to a lower point. If oil leaks out around the seams of the two halves of the crankcase, the capacity for leakage will be very great, and the pump employed for purposes of oil circulation may fall below the necessity under such conditions. Fig. 11 shows a method of packing the joint of the two halves of the crankcase which can be taken advantage of at any time. The finished face of the flange of the lower half of the crankcase is scored, using a diamond-pointed chisel for the purpose, and a piece of string is imbedded in the score protruding above the common level, so that when the two halves of the crankcase are bolted together the string is compressed and the joint is made tight.

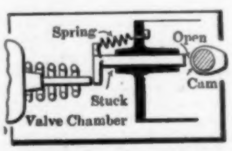


Fig. 10—Offset tappet designed with a foot which is likely to cause binding if the lubrication is sparse

When the Gasoline Supply Fails—In practice there are two methods in vogue for the supply of gasoline from the tank to the carbureter. If the tank is placed above the level of the float bowl in the carbureter, the gasoline flows under the force of gravity, and all that has to be done is to keep the gasoline pipes free from accumulations of jelly, if they have not been plugged up by waste in the process of manufacture, in the first instance. It will be understood, of course, that in a gravity-feed system the gasoline tank must have a vent hole in it, otherwise, as gasoline runs out, a vacuum will be created, and when the pressures are balanced, as a result, the gasoline will quit running out of the tank, and the motor will be starved of its fuel supply. Referring to the system in which the gasoline tank is below the level of the carbureter, pressure is fed to the gasoline tank through an automatic valve, which regulates the amount of the pressure from the supply as it comes from the combustion chamber of one of the cylinders of the motor. In this system the gasoline tank must be pressure-tight, and, as a rule, the leakage, if there be any, will be found at the filler. Fig. 12 shows a filler for a gasoline tank, and a cover or cap with lugs protruding out, by means of which, through the good office of a bar of iron, the cover may be screwed down tight against the leather packing, and attention is called to the undercutting of the thread at I_1 and I_2 for the purpose of locking the leather washer into place, and in the cutting of the leather washer, the diameter of the same is made greater than the inside diameter of the threaded portion of the cover, so that when it is pressed into place it will be self-fastening.

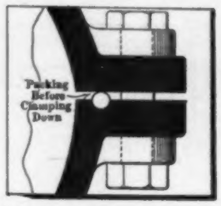


Fig. 11—Section of a crankcase at the joint showing how to pack the same if it is desired to prevent wheezing and loss of lubricating oil

Looking for Noise and Loss of Power—When a motor operates satisfactorily at low speed, but fails to sustain its reputation at the higher levels of speed, and noise creeps in to add to the discomfiture of the owner, it is suggested that the valve springs be examined, rather with the expectation that they will show a loss of temper, unless it happens to be true that they were not strong enough for the work in the first place. It has been found in practice that a valve spring for a motor with a bore of 4 1-2 inches should exert a pressure of a minimum of 36 pounds, which strength will suffice if the motor operates at about 800 revolutions per minute. But if the motor is designed with a high compression, including relatively large valves, and such other characteristics as will permit of running the speed up to the region of 1600 revolutions per minute without an undue falling off in the rate of power delivery, if the time arrives when the motor ceases to perform properly, it is a moral certainty that the valve springs are working below the requirement. The pressure of the spring for a motor of this size with high compression and high-speed power delivery should be about 70 pounds. For the convenience of those who do not wish to go into the designing of springs at length a table is here given, by means of which the sizes of springs as required for valves may be found, knowing the pressure required. Fig. 13 is a diagram of a spring which should be used in conjunction with the table of sizes.

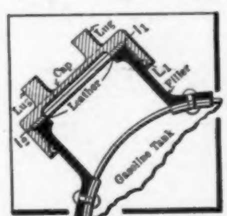


Fig. 12—Section of a filler on a gasoline tank showing how to make the same so that it will pack tight against pressure

Improperly Designed Valves Warp—If valves are properly made of the grades of material that are known to serve efficaciously under heat and shock conditions, assuming that the valve seats do not crush out, they will last for a long time with occasional grinding as a precautionary measure, but if the metal of which the valves are made has internal stresses, warping will transpire, and grinding will become an impossibility. Another source of trouble follows in the path of poor design as shown in Fig. 14, in which the mushroom is attached to the stem of the valve without a fillet. As the exhaust gases, which are red-hot, sweep over the mushroom, owing to the

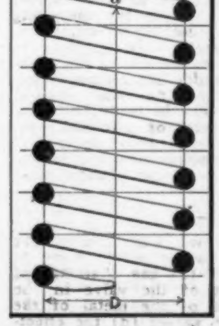


Fig. 13—Section of a valve spring which is used in connection with the tabulation in fixing upon the sizes of springs to use

large surface of the latter, much heat is taken up, but, the fillet being absent, the mushroom heats up and the stem stays cold, so that warping takes

TABLE OF SIZES OF SPRINGS FOR POPPET VALVES

Diam. Spg. from Center to Cir.	Diameter of Steel Wire. 1-16"		1/8"		3-16"		1/4"		5-16"	
		in.		in.		in.		in.		in.
3/4"	8.1 / 1.5	1.7	65. / 24.	.85	221 / 122	.57	—		—	
7/8"	7. / .95	2.3	56.1 / 15.2	1.15	189 / 76.8	.77	—		—	
1"	6.1 / .64	3.	49.1 / 10.2	1.5	166 / 51.5	1.	392 / 1627	.75	—	
1 1/8"	5.6 / .45	3.8	43.6 / 7.1	1.9	147 / 34.4	1.27	349 / 114.2	.95	—	
1 1/4"	4.9 / .33	4.7	39.3 / 5.2	2.15	132 / 26.4	1.57	314 / 83.3	1.18	613 / 203	.94
1 3/8"	—		35.7 / 3.9	2.85	120 / 19.8	1.9	285 / 62.6	1.43	557 / 153	1.14
1 1/2"	—		32.7 / 3.	3.4	110 / 15.3	2.26	262 / 48.2	1.7	511 / 118	1.36
1 5/8"	—		30.2 / 2.4	4.	102 / 12	2.	241 / 379	2.	472 / 93	1.59
1 3/4"	—		28 / 1.9	4.6	95 / 9.7	3.1	22.4 / 30.4	2.3	438 / 74	1.85
1 7/8"	—		26.2 / 1.5	5.3	88 / 78	3.54	209 / 24.7	2.65	409 / 60	2.12
2 "	—		24.5 / 1.3	6	83 / 6.4	4.	196 / 20.3	3.	383 / 50	2.42
2 1/8"	—		—		78 / 5.4	4.54	185 / 17	3.41	361 / 41	2.73
2 1/4"	—		—		74 / 4.5	5.1	174 / 14.3	3.82	341 / 35	3.05
2 3/8"	—		—		70 / 3.8	5.7	165 / 12.1	4.26	323 / 30	3.41
2 1/2"	—		—		66 / 33	6.3	157 / 10.4	4.72	307 / 25	3.77

place. In this case the valve cannot seat, and there will be a gap on one side, with no gap on the other, as indicated in the figure.

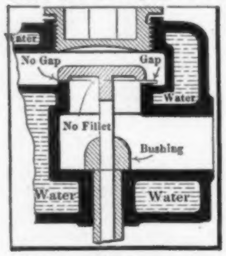


Fig. 14—Section of a poppet valve of the type that warps in service due to the absence of a fillet under the mushroom

Referring to Fig. 15, it will be seen that the valve stem is attached to the mushroom by means of a liberal fillet, and the heat that is absorbed over the large surface of the mushroom is permitted to travel through the length of the stem and is tapped away to the water of the jacket surrounding the guide. The result is that the va've may be ground to tightness, and it will so remain. since warping will be prevented.

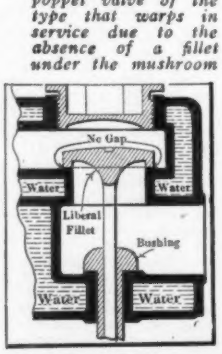


Fig. 15—Section of a motor cylinder showing a fillet under the mushroom of the valve which prevents warping

Spark Plugs Should be Examined Frequently — The difference between a well-nourished smart - performing motor and a lazy, shiftless source of power is frequently represented by the relation of clean to dirty spark plugs. The only way that an automobilist can tell whether or not spark plugs are clean is to look at them. To make an examination it is necessary to screw the spark plugs out of the cylinder, examine them with a critical eye, and if they are free from carbon accumulations it remains to give them a sparking test before screwing them back into the cylinders. This is an ugly thing to do. As a rule, the spark plugs are hot, their position is cramped, and it is difficult to get at them with a wrench unless a special form of socket wrench is carried in the tool-kit for the purpose. After the plugs are screwed out of the cylinders, in order to give them a sparking test, the body of the spark plug must be in metallic contact with the cylinder of the motor, and it is suggested that a flat piece of steel or other metal be attached to the cylinder adjacent to the spark plugs, and so bent, terminating in a fork, as to accommodate the spark plug as shown at B, Fig. 16. The spark plug is shown at A as it is screwed into the cylinder.

Spheroidal Action Defeats Good Performance—Frequently it is found that motors perform badly because of spheroidal action, which is induced by an accumulation of incrustation on the exterior water-swept surfaces of the cylinders, which action is described as when water is thrown on a surface of highly heated metal, it rolls about in spheroidal drops or masses at a temperature several degrees below ebullition and without actual contact with the heated surfaces—a phenomenon due to the repulsive force of heat, the intervention of a cushion of non - conducting vapor and the cooling effect of evaporation. This is a peculiar situation, and it means that the heat stored in the section of the cylinder walls is prevented from reaching the body of water that is apparently circulating and sweeping the exterior surfaces, resulting in the overheating of the cylinders and the driving out of mixture while the inlet valves are open so that the quantity of mixture available during compression interval is materially reduced and the conditions governing ignition are uneconomical. The way to overcome spheroidal action, if the cooling system is in good working order excepting as to incrustation is shown in Fig. 17, depicting a form of scraper that may be inserted in the waterjacket orifice after the cover is taken off, by means of which the incrustation may be removed, thus permitting the heat to pass unmolested into the circulating water and defeating spheroidal action.

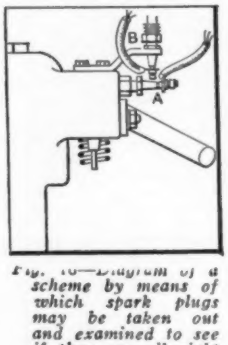


Fig. 16—Diagram of a scheme by means of which spark plugs may be taken out and examined to see if they are all right

Irreparable Damage Done by Bungling Workmen—When an automobile is delivered at the repair shop, if it is to be generally overhauled, the workmen will be set to the task of disassembling the car, and when the motor is approached, after the accessories are removed, the cylinder - holding bolts will be taken off and the cylinders will be withdrawn. If the workmen are skilled in the art they will carefully lift the cylinders straight away from the pistons, proceeding with care in order not to damage the piston rings. But if the workmen are lacking in forethought they will drag the cylinders away from the pistons, twisting them, perhaps, in the process, and the piston rings will be irreparably deformed, if not broken. When the cylinders are being put back it will be something of a job to enter each cylinder on its piston without damaging the rings. As shown in Fig. 18 the rings are expanded when they are not held in compressed relation by the cylinder walls, and unless the cylinders are tapered off at the lower extremity it will be almost impossible to accomplish the task without doing damage. But even if the cylinders are properly tapered, as shown in the figure, the workmen will have to compress the rings to the flush position at the instant they engage the beveled edges of the cylinders, and it is at this time that careless employees accomplish the ruin of the rings and reduce the repair to a worthless effort, since, if the rings are deformed when the motor is reassembled and started, it will be found that the compression will be poor, owing to leakage past the piston. One way to compress the rings is to take two wraps of a stout cord around them, and just as the rings enter the bore of the cylinder the cord may be loosened up when it will depart from its position and the rings will expand against the cylinder walls in perfect safety. This operation should be repeated for each ring.

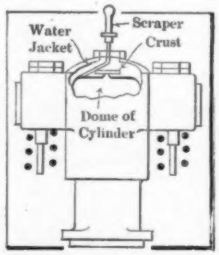


Fig. 17—A T-head cylinder with a part of the jacket broken away, showing the use of a curved scraper to remove scale

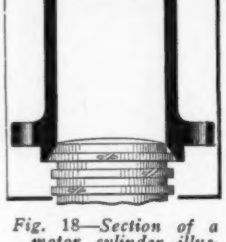


Fig. 18—Section of a motor cylinder illustrating the beveling of the same so that the piston will enter without damaging the rings requiring their replacement by new rings

Ignition Success Depends Upon Location of Spark Plugs—Diversity of opinion seems to locate the spark plugs in the cylinders of motors at all points of vantage, and, strange to relate, the success of the individual effort depends upon the characteristic of the particular motor. In the soft performing motors, if the lubricating problem is handled with care, the location of the spark plug is a relatively unimportant matter, primarily on account of the cooler way in which the motor works, and again in view of the fact that the speed is lower and the time of the propagation of the flame in the mixture is long enough to make up for moderate deficiencies. But if the motor is of the hard performing type, which means that the compression will be high and the speed will be much faster accordingly, spark plug trouble will be more imminent, and it seems to be the better part of valor in such examples to locate the spark plugs in the train of the incoming cold mixture. In well-made motors, as they are designed for general service, which suggests flexibility and not too high a compression, the spark plugs may be placed as shown in Fig. 19, and there is some advantage in making provision in the original design according to this plan, for then it will be possible to resort to the double ignition system, if in the course of time it becomes a seasonable proposition. It is now well appreciated by experts that a double simultaneous ignition, if the spark plugs are placed remote from each other in the combustion chamber, has the effect of increasing the power of the motor and decreasing the uncertainties.

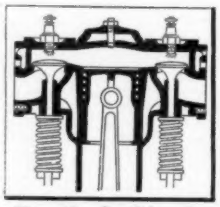


Fig. 19—Section of a T-head cylinder showing the spark plugs located over the inlet and exhaust valves as used in double ignition work

Flywheel Trouble Is Not Uncommon—The flywheel of an automobile motor is the most innocent-looking member of the whole family of components, and yet there resides within this rotating mass a force that will do more damage than will be accomplished by an exploding gasoline tank; moreover, the average automobilist fails utterly to appreciate the importance of the flywheel and what it is for. A single-cylinder motor of the four-cycle type will not run at all in the absence of a flywheel, due to the fact that power is delivered during one stroke of the piston and pumping losses are suffered during the remaining three strokes of the piston in the completion of the four cycles, and it is for this reason that the motor was originally termed a four-stroke cycle motor; in other words, it took four strokes of the piston to complete the cycle. It will be of importance to the relatively inexperienced automobilist to obtain a good conception of just what constitutes a cycle. Referring to Webster's Dictionary: "Cycle—An interval of time in which a certain succession of events or phenomena is completed, and then return again and again, uniformly and continuously in the same order; a periodical space of time marked by the reoccurrence of something peculiar; as the cycle of the seasons, or of the year." It is at once possible to refer this definition to a four-stroke cycle motor and to substitute the co-relating ideas, it being the case that in the motor to complete the cycle it is necessary to accomplish the end. The end is to burn the gasoline in the presence of oxygen and abstract its energy, interpreting the same in the form of power, which the motor does. The work is done on a cycle basis; that is to say, the reciprocating piston makes one stroke, sucking in the fuel mixture; the second stroke is devoted to the compression of the mixture so that it will burn readily; at the instant of the beginning of the third stroke the mixture is ignited and the dissipating energy is absorbed by the piston, forcing it to traverse the length of its third stroke, after which the fourth stroke begins, and the scavenging of the cylinder is done during this stroke, thus paving the way for the starting of a new cycle. It will be seen that the power stroke is the only one during which power is made, and the three relating strokes deliver losses only, and they are called "pumping losses." The flywheel serves as an energy transformer. What it does is to absorb the excess of energy that is abstracted from the fuel during the power stroke, and this excess of energy is delivered by the flywheel to the rotating mass during the three futile strokes, thus furnishing power to offset the pumping losses, and the measure of power that is necessary to equalize the

delivery of useful power during the four strokes of the cycle. A device that is capable of handling energy on a large basis, in such a nimble way, has within its makeup the elements of destruction, and the flywheel, in order that it will be safe, must be securely fastened to the crankshaft by means of a suitable number of holding bolts, as shown in Fig. 20. It is the duty of the automobilist to tighten these bolts up as the occasion requires, and the nuts should be castellated and locked by means of cotter pins, although, as the figure shows, there is no provision for locking, and in the motors that are made without a locking means for the nuts on the holding bolts riveting over is the only thing that can be done. There is one other source of possible danger, which will be imminent if the clutch is permitted to get out of order, and it slips more or less during the operation of the car, thus heating up the rim of the flywheel. There are two causes of clutch slipping, the first of which is represented if the clutch is not big enough for the work, and the second follows if the clutch facings are in poor fettle. Referring to Fig. 20, the axis of pressure is that of the rotation as shown by the dotted line ac, x, and the resulting pressure, as indicated by the line ab, z, gives:

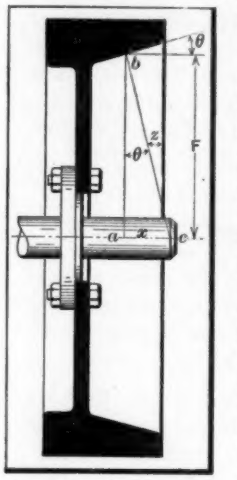


Fig. 20—Section of a flywheel showing the method of flanging without a locking means for the nuts on the holding bolts

$$\frac{ab}{ac} = \frac{z}{x} = \frac{1}{\sin \text{angle}}$$

Using f to represent the coefficient of friction of the facing material, it remains to so design the clutch that the resulting pressure z will equal the axial pressure divided by the sine of the angle abc. This is not always so and in clutches that persist in slipping, despite care lavished upon the friction facings, it is believed that the addition of cork inserts will be justified, and it is a poor clutch that will not work after the cork inserts are applied.

Half the Motors Running Are Out of Time—The reason for desiring to accurately time the motor is based upon the necessity of igniting the mixture between the interval of inspiration and the interval represented by the power stroke. The mixture should never be permitted to burn during the power stroke. This stroke should be devoted to expansion work. On the other hand, the ignition should not take place before the completion of the suction stroke. In poorly timed motors the gas being taken in is reduced below the best level and the work that the compressed mixture is capable of doing falls below par because the burning of the gas is prolonged into the power stroke. In dealing with this problem there are four prime considerations: (a) The carbureter must supply a well-balanced mixture; (b) the intake valve must be timed to admit the fullest measure of mixture; (c) the ignition must be energetic and precisely timed so that the gas will be ignited and burned before the beginning of the power stroke; (d) the exhaust valve must be opened at the instant it will permit of the scavenging of the cylinders during the remaining stroke, thus paving the way for the beginning of the succeeding cycle under the most favorable conditions. In dealing briefly with this problem it will suffice to state that the timing of a motor must be varied to suit its characteristic and the speeds of its range of performance. Fig. 21 is designed to tell the reader how timing of the valves and the spark is reckoned, and one type of timing is given in this diagram, the conditions being such that a motor so timed will be a good average performer. This will be true if the motor is of medium size and operates between 800 and 1500 revolutions per minute. As a further aid to those who are in quest of exacting results, a table of valve settings is here reproduced from *The Motor-Car Journal*, as being the latest information in some detail bearing upon this important subject.

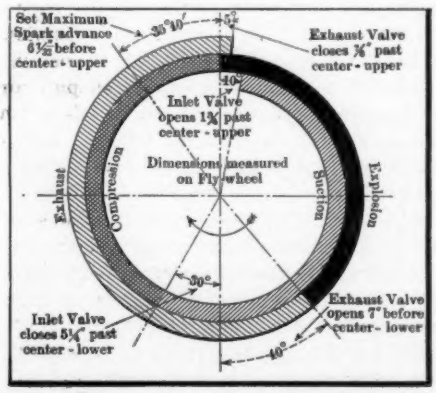


Fig. 21—Diagram for use in timing motors, giving the timing of a motor on a basis of flexibility of performance

Small Parts Have a Knack of Straying Away—It is not because they are small, but on account of insecure fastening, that bolts, nuts, hub caps, and other like members of automobiles back off from their position and get lost. Hub caps are great offenders in this regard, and designers too frequently overlook important principles at a time when they are giving these members the scant attention that their lowly position would seem to indicate. It is regrettable that the main point is overlooked; hub caps are assigned to the duty of keeping the silt of the road out of the road-wheel bearings, and the automobilist who runs a car for a single mile with a hub cup off will find himself out of pocket to the tune of a set of high-priced ball or roller bearings, and he takes a chance of getting hurt when the bearings fail and the wheel parts company with the automobile. Fig. 22 shows a hub cup that will not stay on, merely because it is screwed up on the threaded portion of the hub, and it is suggested that a wire lock G in a groove chased in the hub cap, extending around the circumference with a bend W through registering holes at H_1, will do the work; nor is it a great undertaking to make this provision in a given case if the designer of the automobile runs out of talent before he gets to the hub caps. While the opportunity affords, attention is called to the nut N, which should be locked on, and the best way to accomplish this is to castellate the nut as shown, and, after drilling a hole through the threaded part of the spindle in the region of the castellations, a cotter pin may be passed through the hole, engaging the wings of the castellations, after which its ends may be spread so that it cannot back out. The thought will come to the automobilist of some discrimination that the other small parts, like hub caps, should be locked on in this or some other permanent way. At all events, it is not desirable to run a car after the cap comes off.

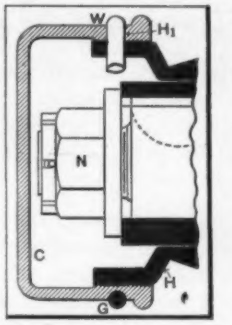


Fig. 22—Section of the hub of a wheel showing how to lock the hub cap so that it will not drift off

DIAGRAM OF THE VALVE SETTING OF GASOLINE MOTORS.

Motor.	Inlet Valve.		Exhaust Valve.	
	Opens.	Closes.	Opens.	Closes.
Albion	14° late	30° late	44° early	16° late
Ariel, 1908	18½° late	42° late	45° early	5° late
Arrol-Johnston, 15.9-h.p.	16° late	36° late	53° early	7° late
Aster (high speed), 1908	4 mm. late	18 mm. late	15 mm. early	dead centre
Aster (low speed), 1908	1 mm. late	1 mm. late	15 mm. early	dead centre
Austin, 15, 18-24, 40, 50 and 60-h.p.	12° late	10° late	45° early	13° late
B.S.A., 15-20-h.p.	14° late	14° late	36° early	dead centre
Bedford, 15-18-h.p.	3 mm. late	14½ mm. late	25 mm. early	2 mm. late
Belsize, 14-16-h.p.	27° late	21° late	61° early	9° late
Bentall, 16-h.p.	dead centre	35° late	45° early	10° late
Benz	dead centre	22° late	50° early	3° late
Berliet, 22-h.p., 1908	17° late	38° late	48° early	9° late
Brasier, 1908	7° late	25° late	45° early	dead centre
Charron, 20-30-h.p., 1908	1° late	dead centre	44° early	dead centre
Chenard-Walcker, 1908	dead centre	36° late	36° early	dead centre
Cottin-Desgouttes, 10, 15, 22, 40 and 50-h.p.	15° late	32° late	45° early	7° late
Daimler (Valveless engine)	dead centre	45° late	55° early	20° late
Darracq, 10-12-h.p., 1908	dead centre	30° late	48° early	dead centre
Deasy (J.D.S.), 14-h.p.	20° late	35° late	55° early	15° late
Deasy (J.D.S.), 18-h.p.	24° late	26° late	41° early	dead centre
De Dion (single-cyl.)	3 mm. before suction stroke	¼ to ⅓ of stroke after suction stroke	⅛ of stroke before exhaust stroke	3mm. after completion of exhaust stroke
De Dion (multi-cyl.)	dead centre	ditto	ditto	dead centre
Dennis, 28 and 35-h.p., 1908	30° late	20° late	40° early	10° late
Enfield, 10-12 and 18-22-h.p.	13° late	10° late	53° early	10° late
Enfield, 16-h.p.	14° late	14° late	53° early	10° late
Fiat, 12-14-h.p.	25° late	36° late	50° early	10° late
Fiat, 15-20, 28-35, and 40-50 h.p.	10° late	20° late	30° early	5° late
Ford, 20-h.p.	½ in. late	½ in. late	½ in. early	dead centre
Gregoire	28.2° late	50.3° late	56.5° early	22.8° late
Germain	4° late	35° late	45° early	10° late
Hillman, 12-15 and 25-h.p.	17° late	8½° late	33½° early	8½° late
Hotchkiss, 1908	17° late	33° late	44° early	10° late
Humber, 10-12-h.p. and 15-h.p., 1907	20° late	15° late	35° early	10° late
Humber, 12 and 16-h.p.	13° late	37° late	47° early	13° late
Lanchester, 20-h.p. (four-cyl.)	7° early	25° late	50° early	9° late
Lanchester, 28-h.p. (six-cyl.)	7° late	25° late	40° early	7° late
Mercedes	1 mm. down suction stroke	dead centre	15 mm. from bottom of suction stroke	½ mm. down on suction stroke
Mors, 12-h.p.	13° 20′ late	dead centre	44° early	dead centre
Mors, 15-h.p.	27° 30′ late	33° late	47° early	22° late
Mors, 20-h.p.	12° 51′ late	26° 37′ late	43° 3′ early	9° 4′ late
Mors, 30-h.p.	13° 30′ late	dead centre	39° 30′ early	dead centre
Motobloc, 14-16-h.p.	10° late	10° late	15° early	10° late
Panhard, 8-h.p. and 10-h.p., to end 1909	automatic	automatic	⅜ to ½ in. early	1-16 in. late
Panhard, 15-h.p. and 18-h.p., to end 1909	1-16 in. late	⅛ to ¼ in. late	⅜ to 9-16 in. early	1-16 in. late
Panhard, 24-h.p., to end 1909	1-16 in. late	½ to ⅝ in. late	⅝ to 11-16 in. early	1-16 in. late
Panhard, 12-15-h.p., 1910	dead centre	13 mm. late	14 mm. early	dead centre
Panhard, 15-h.p., 1910	dead centre	12 mm late	14½ mm. early	dead centre
Panhard, 25-h.p., 1910	dead centre	13 mm. late	16 mm. early	dead centre
Panhard, 20-h.p., Silent Knight, 1910	4½ mm. late	13 mm. late	16 mm. early	dead centre
Peugeot, 10-12-h.p., 16-20-h.p., and 35-45-h.p.	1 mm. late	2 mm. late	22 mm. early	dead centre
Peugeot, 12-15-h.p.	1 mm. late	2 mm. late	20 mm. early	dead centre
Peugeot, 22-30-h.p.	1 mm. late	2 mm. late	23 mm. early	dead centre
Phoenix, 8-10 and 10-12-h.p.	28½° late	28½° late	41½° early	11° late
Piccard-Pictet	20° late	20° late	40° early	dead centre
Renault, 8-h.p., 1908	23° 30′ late	26° late	32° early	10° late
Rochet-Schneider	20° late	20° late	40° early	dead centre
Sheffield-Simplex, 14-20, 20-30, and 45-h.p.	5° late	26° late	45° early	10° late
Sizaire-Naudin (single-cyl.)	dead centre	3 to 4 mm. late	12 to 13 mm. early	dead centre
Star	12° late	17° late	47° early	9° late
Straker-Squire, 15-h.p.	8° late	22° late	45° early	5° late
Sunbeam	20° late	49° late	37° early	7° late
Thornycroft	20° late	20° late	50° early	10° late
Unic, 20-h.p., 1908	34° late	40° late	53° early	10° late
Vauxhall, 1908	30° late	24° late	36° early	15° late
Vinot, 12-16-h.p., 1908	15° late	15° late	30° early	dead centre
Wolseley	11° late	19° late	38° early	7° late

It Stands to Reason.

Discussing some of the things that will bow to a simple reasoning process, thus saving the worry of poring over a quantity of intricate formulæ, and avoiding the necessity of crying for help, when, in all fairness, it is a mere matter of thinking in rational channels.

THAT the life of an automobile may be longer than the owner is aware of, but a considerable amount of noise gets in the way of his good judgment, and he naturally reaches the conclusion that the car is worn out simply because it creates a din—the judicious use of a set of tools and the application of lubricating oil is all that stands in the way of a further measure of excellent service.

THAT a motor has but one way of telling the owner of the automobile how it feels in the face of abuse; it quits working. When the owner of the car deals with "strikers" in his manufacturing establishment he finds out what they want and the result of the conference is either that their demands are appeased or a compromise is reached. Why not treat the automobile motor at least as well as the strikers?

THAT the power of a motor, while it comes from a mixture of gasoline and air, will fall to a low level if the ignition system is a weakling and the battery is the part that wears out; it remains to examine the battery first, making sure that it is capable before it will be wise to tamper with the adjustments of the mechanisms. A good source of electrical energy is a successful persuader in favor of enjoyable performance of a motor in nine cases out of ten.

THAT life is too precious to be risked on a good motor, if the brakes are out of whack. The motor makes the automobile go fast and it remains for the brakes to stop the car in the face of danger. The danger is a mere condition that is induced by the good performance of the motor, and the bad performance of the brakes.

THAT imminent danger resides in a high-powered automobile in the face of well-performing brakes, and in the presence of a good stretch of road if the driver of the car is so obtuse as not to know that the snubbing of the motion is based upon a plurality of considerations. If the brakes are applied too vigorously, traction will be killed and the ultimate result is left to chance, but in any event it takes time and the judicious application of the brakes to stop the car, all of which, when properly interpreted, means that a certain distance must be covered before the car will stop and it is one of the possessions of an intelligent driver to be able to judge of that distance.

Only a Question of Time

The rate of progress in the adoption of mechanical transportation in the near-by past indicates that the time is rapidly approaching when the use of horses in all large business enterprises will be materially curtailed and, with the progress of the years, almost entirely discontinued.

CIVILIZATION from the remotest time has progressed in proportion as good roads were constructed, and it must be that human interchange—interstate commerce, if you please—is the foundation upon which advancing civilization rests. In the stone age, when felled trees were the carriages of the rich, and the females of the family toted the wash to the laundry, the merchants of that time were mostly "poachers" and the little red schoolhouse on the hill was as yet an unknown quantity. Poverty and its oppressions made thieves out of men so environed and the more fortunate settlers in the districts where Nature was a more liberal provider were compelled to arm and defend themselves against marauding bands; the war chariot was developed under stress of these rude conditions, and civilization grew, ultimately reaching the grandeur of the Roman Empire. Time seems to have indicated that warriors are as much of a curse as marauders, and the four-wheeled carriage drawn by horses, using the Roman roads that were designed for the efficacious movement of troops, launched a higher form of civilization, and barring the period known as the "dark ages" progress has been indicated with precision by the improvements that have been wrought in transportation methods. To the man who permits pessimism to subdue him advancement is a difficult task, but it is hard to understand how support can be given to the argument of the man who contends against mechanical transportation, when history tells us such a complete tale and when the facts, as they are laid bare to every onlooker, are so absolutely in favor of a more speedy form of transportation that there is nothing to do but lie back and accept the inevitable.

Adopts Motor for Army

After a series of long and exhaustive tests the Austrian War Department has decided to adopt a two-ton truck as being best adapted to the work of putting its sixteen army corps on an up-to-date war footing.

AUSTRIA'S military budget for 1911, as laid before the delegations in Buda-Pest, embraces estimates for supplying the entire Austrian army with automobiles as a means of transport. Already the system has been made a certainty in certain quarters and it will not be a great while before the entire sixteen army corps of the Austria-Hungary forces will be traveling, whenever occasion demands, in automobiles. This decision was arrived at by the War Office at the close of a series of severe and exhaustive tryouts in Vienna and Budapest, the trials having involved the use of automobiles with a carrying capacity of loads weighing from four to eight tons. After a considerable number of tests it was found that loads of this capacity were too heavy, and two-ton trucks were adopted.

Automobiles vs. Ox Carts

Mexican coffee planters are beginning to realize the benefits of mechanical transportation as against the primeval facilities afforded by the lowly ox and the two-wheeled cart and are looking about for a means of emancipating themselves from the thraldom of centuries.

THE Soconusco, Mexico, coffee planters are dependent upon Tapachula for their supplies. To this end there is a favorable disposition toward automobiles as a means of freight as well as passenger traffic, it being necessary to make frequent trips back and forth. At the present time ox-carts are the mainstay of transportation operations and planters are agitating in favor of the adoption of motor cars. In the beginning there was talk of building a tram line, but the Spaniards who went to Chiapas in Tapachula for that purpose gave it up, having found another Spaniard ahead of them. This was a twelve-month ago. But the tramway has not been built, and the people of the vicinity have made up their minds that they would like to see an automobile service introduced. The road, fifteen miles in length, from the Port of San Benito to Tapachula, is amenable to easy shaping for automobile traffic. There is already a motor car service between Tuxtla Gutierrez and Arriaga station (once called Jalisco), both passengers and freight being carried. The trip is made in six hours (formerly the journey required from three to four days), the fare one way being $15 in gold. The owners of the line intend to extend the service as far as San Cristobal and Comitan.

The great difficulty to be gotten over in the vicinity of Chiapas is the superabundance of cobblestones within the limits of the town and the massive heaps of dust that infest the country roads during the Summer months, as well as the pitfalls of mud that cover the highways in the rainy season. It is thought that an automobile would need to be especially made if intended for use in this territory. Very strong machines would be required to buffet the shock caused by running over the cobblestones.

Carbureters and Their Functions

Distinctions Drawn—Plain and Automatic Types

It is proposed to show in this article, by means of diagrams, the results that should be obtained from automatic carbureters, dealing more particularly with the field of automatic operation. It is translated from an article that appeared recently in "La Vie Automobile," from the pen of M. A. Lauret.

THE carburetion problem can briefly be summarized as follows: A motor must be capable of giving off its maximum power and efficiency at all speeds and under all loads, which means irrespective of the number of revolutions and the value of the resistance. The questions of maximum power and efficiency are of the utmost importance because the motor may have a better efficiency at a certain speed for a degree of the testing apparatus below its maximum and *vice versa*. The experiments of Professor H. Hopkinson have clearly shown that as a matter of fact a motor retains its maximum power when the gasoline consumption is increased in the proportion of 2.6:2; or, in other words, a motor that consumes 20 liters per hour can also give its maximum power when consuming 26 liters per hour. That is why it is necessary to take into consideration maximum consumption with maximum power.

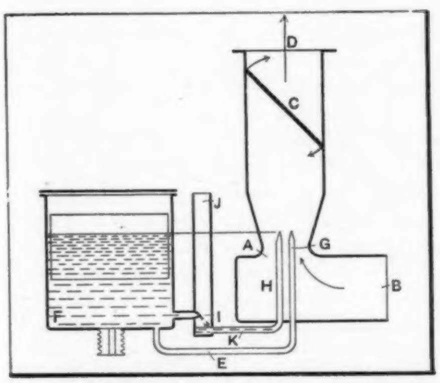


Fig. 1—Sectional view of a carbureter that works entirely automatically without the aid of additional air

It is difficult without experience to determine the proportion of air and gasoline it is necessary to maintain to assure this maximum result for all speeds. The proportion by no means remains constant, and it is probable that at high speeds a comparatively weak mixture can be utilized than at lower speeds. Nevertheless, one can assume, as a first approximation, that the mixture should have a constant proportion; that is to say, the relation of $\frac{\text{gasoline}}{\text{air}}$ must not vary in relation to the speed.

The Difficulty to Be Overcome by Obtaining an Automatic Carbureter

Experience shows that this is the correct path to follow, and reasoning shows also that this is right. In fact, a jet placed in a suction tube for air emits at high speeds, and in consequence at large depressions, considerably more gasoline in proportion to the air that is passing in the tube. The property of an automatic carbureter is to correct this defect of the jet and, in consequence, restrict the output of the jet at high speeds and permit of a larger proportion of air passing. It follows, therefore, that if it is not found necessary to retain the mixture at a constant point, but, on the contrary, that it should be thinned off at high speed to arrive at this result, the importance of the automatic device must be increased to make any corrections therewith, but in a different measure than theory dictates. In practice the mixture should be maintained more constant than one is led to believe.

The main difficulty in the realization of an automatic carbureter lies in the fact that the law that governs the flow of gasoline through a tube and that which governs the passage of air through a pocket are not analogous. Various methods have been tried to re-establish the analogy between the two laws of flow by every sort and kind of jet, such as threading and chasing the interior, placing obstacles in the passage of the jet so as to create a greater resistance at high speeds, mixing chambers of a special form to facilitate the passage of the air at high speeds, etc. But it seems that these only serve as an insufficient compromise; the need makes itself felt for some automatic disposition of a compensating nature, no matter what the depression may be, to overcome the tendency of the principal jet to give off too much gasoline as the depression increases.

The words, "no matter what the depression may be," were used above with design, without adding, as is customary, "no matter what the opening of the air choke may be." If the carbureter shown in Fig. 1 is studied for a moment it is easy to understand that the depression at A—that is to say, the level of the jet—is variable according to the speed of the motor and the opening of the butterfly C. In other words, it is a matter of these two known quantities and these only. This is taken as the basis of the first analysis, without taking into consideration the pressure of the temperature and the amount of humidity of the atmosphere, and also supposing that the motor in question is not fitted with valves that have a variable lift.

It follows, therefore, that for each opening of the butterfly according to the position of the gas lever there is a corresponding curve of depression in working of the speeds of the motor, and consequently in the work that has to overcome the resistance. The gases being almost cut off, it is possible to cause the motor to run at 200 revolutions per minute (slow speed running empty) to 1,500 revolutions per minute (car running the motor when going down a hill); and with the gas being fully opened one can pass from 200 revolutions (start of an acceleration) to 1,500 revolutions, which is equal to full speed on a level road.

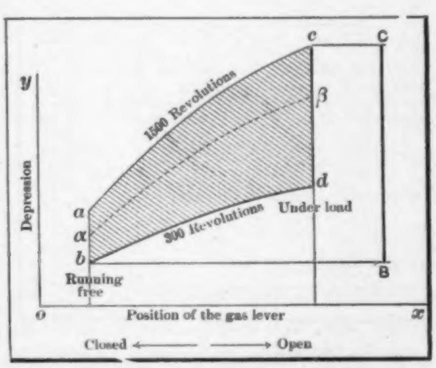


Fig. 2—Field of automatic action of an ordinary carbureter. α β show the depressions while working at the different positions of the throttle lever. d b, curve of depressions corresponding to the slowest speed at which the motor can run. d c, curve corresponding to the greatest possible angular speed. a b c d, area of depressions or field of automatic operation

Field of Automatic Operation

If we trace a curve of depressions, using them as ordinates and the positions of the gas lever as abscissæ, a curve will be found $\alpha\beta$ for each speed of the motor, which rises constantly, as shown in Fig. 2. In this figure the curve b d corresponds to the

lowest speed that it is possible to run the motor (300 revolutions, for example), and *a c* corresponds to the greatest speed at which the motor can run. All the curves of depressions due to the opening of the gas lever are enclosed in the shaded section *a b d c*. This area is known as the zone of depressions or field of automatic operation because all the depressions corresponding to the speeds of the motor and positions of the butterfly are represented by points in this zone.

If a line is drawn parallel to the axis of the abscissæ the straight line B C will be obtained which corresponds to the difference in the maximum and minimum depressions. It follows, therefore, that it is sufficient to assure automatic operation for all the depressions between the points B and C without taking into consideration the exact position to which they correspond—that is to say, what the position of the gas lever or the speed of the motor may be. The lowest point naturally corresponds to the minimum speed of the motor running empty, and the high point C is equal to the maximum depression at high speed while the car is running with the throttle fully opened. While considering the zone of automatic operation light is immediately thrown on the working of a semi-automatic carbureter. The type of carbureter that is known as semi-automatic is that where the gas lever correlatively modifies the proportion of the mixture either by acting on the depression of the jet level, modifying the flow of the gasoline, or by introducing supplementary air.

If each of the abscissæ (position of the lever) is given a point correspondingly included in the zone of automatic operation it is possible to strike a curve through the points which will be the *"automatic curve."* This means that for each opening of the butterfly valve there is only one speed of the motor at which suitable carburetion is realized. The carbureter instead of being automatic in the whole zone is only automatic along a certain line. One can choose different types of curves of automatic operation, making it pass through certain points that are particularly suitable. Reference to Fig. 2 will make this clear.

Two of these points are evidently the point *b*, which is equal to the motor running empty slowly, and the point *c*, corresponding to the speed while the car is running at its highest speed on the level with the throttle fully opened. As only one point on each vertical line can be chosen it is not possible to make the curve pass through the point *d*, corresponding to the slow speed and with full throttle, and through the point *c*, corresponding to the same opening but at high speed. The carburetion would be defective at either one of the two points or both.

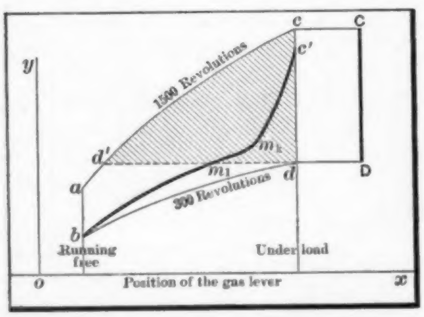


Fig. 3—Diagram of the curve of an automatic carbureter in the field of automatic operation. *b m c'* shows the curve of automatic operation passing through the point of slow running and following practically the curve of uniform running to within the neighborhood of the maximum opening, where it is given a sudden rise so as to pass as near the point *c* as possible

In practice one has resort to the following method: The curve of automatic operation is given a form similar to that depicted in Fig. 3. It starts at the point of slow running and then follows practically the curve of the constant speed nearly up to the point of maximum opening of the throttle, where it is given a decided increase, causing it to strike as nearly as possible the point *c*. By this means the motor picks up well, and as long as the lever is not fully opened, all the points on the sector give good results because the motor is working at either full speed or slowed down, as is the case when picking up or climbing a hill.

When the gases are opened to their full extent the carburetion is only good at high speeds. They must be closed slightly on a hill in order to fall back to a favorable point *m* on the curve. Good functioning is obtained by making the carbureter automatic between the points *c d*; its field of automatic operation, *c d d'*, is, therefore, completed by the branch *c b m*.

A carbureter with a double choke is one where the gas is choked before the jet is affected at the same time that the throttle is closed (taking the Claudel as an example). In this type of carbureter the loss of gasoline at slow speeds—that is to say, small openings of the gas choke—is compensated for by increasing the depression at the jet level in such a manner that the point corresponding to the slow speed running empty will be, for example, *b'*, which is a higher ordinate than *b*, as shown in Fig. 4. The area becomes somewhat deformed and the intervening space between B C within which the carbureter should be rendered automatic is materially reduced and usually to between the points *c d*. In assuring automatic operation between these two points it is possible to solve this problem.

It might be as well to say that there is no means of obtaining automatic action between very large ranges. Even if it did exist its utility would be a questionable matter, because in carburetion all one should strive for is a theoretical idea that gives good results in practice.

Among the different methods that are used in order to obtain practical automatic action there are quite a number that are incomplete, as they but remedy the inherent defect of all jets, which is to give a large flow of gasoline at great depressions, between very small limits. For this reason recourse is had to the method of double choking below and above the jet in order to restrict the field of automatic action as much as possible.

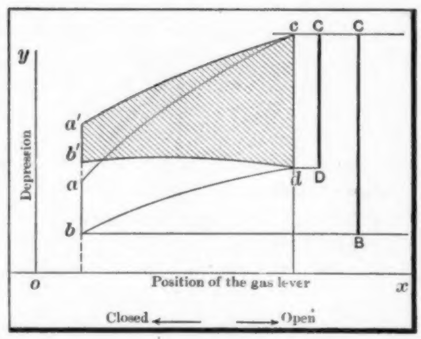


Fig. 4—Reduction of the area of the field of automatic operation by means of a hand regulator

But when a principle is employed that gives automatic action within large limits of depressions there is no necessity to resort to means of restricting such areas. The Zenith carbureter is an example of this. It will be noted that the zone of automatic action is not restricted at all because a simple butterfly alone is used, the closing of which does not in any way increase the depression at the jet level. If at slow speeds advantage is taken of the depression, which is considerable on the surface of the butterfly, the flow from the jet will not be increased at this moment, but all that will take place is that the intake manifold will be filled with gasoline given off by the compensating jet I. Theoretically, this compensating gasoline ought to be taken back by the slide J in Fig. 1 and delivered mechanically to the intake manifold. But in practice it is much simpler to make this depression do the work of an exhausting pump. It is quite natural, therefore, to employ this depression, using it at the point where it is strongest and where the speed of the gases is greatest (in order to obtain the greatest possible mixing), viz., at the restriction of the mixing chamber when the butterfly is open and on the flat surface of the same when it is closed.

It is possible to see from this short study the service that can be rendered by a consideration of the field of automatic operation; it shows clearly the difference between the semi-automatic and automatic types of carbureters.

By means of these latter alone is it possible to assure carburetion practically satisfactory in the very extended limits of speed and charge which are required of the present-day internal combustion motor.

Hats Off to Diller, Neb.

While comparatively few citizens of the United States are aware that there is such a place as Diller, Neb., that fact is to be regretted and ought to be corrected, for that community has accomplished something fine in the way of road making. And it is not so much because of what has been done so far in Diller and its vicinity as it is in the splendid spirit and example afforded. In a word, the town of 500 inhabitants has assigned the equivalent of fifteen days' road work to each man, woman and child and better yet has made good on its assignment.

OMAHA, NEB., May 1—A little town of 506 population has probably done more toward stirring up a good roads spirit in Nebraska than any other city or town in the State. The town is Diller, near the southern border of the State.

The business men of that city subscribed money to build roads, and offered money prizes to the farmers for the best mile of road improved by them during the year. But the climax was reached this spring when instead of offering money prizes at the farmers' own request they simply offered "honor" prizes. Then they turned out themselves to work on the roads.

Recently a day was set aside as Good Roads day. Every business house in the town was closed, and every trousers-clad person repaired to Heiman hill, a hill not far from the town. One hundred and sixty men and fifty-eight teams reported there for duty. Farmers had been invited to attend, many of them responding.

The hill was a bad one, and there was a flat approaching it, the road here being crossed twice by a creek.

After two days' work by these farmers and business men, the hill was graded, the creek bed filled where it crossed the road, dirt piled in on the flat, and it was all ready for the grader to smooth and crown it properly.

The laborers were furnished with a fine dinner by the business men's association, it being dispensed by the women.

There will be more "good roads bees" this summer, when other bad places will be attacked.

In the past two years thirty miles of good roads have been made out of so-called roads, through the efforts of the business men of this little town, thirty more have been pledged for this year, and are well under way. A total of 120 miles is the aim of the business men's association, and it is expected to have this all improved inside of two years more.

The active and successful work of this association began in March, 1909.

At a banquet in that year J. W. Fouts introduced a chart showing Diller in the center of a square with a diameter of 11 miles. It was his idea that the business men undertake the building of good roads within this square, with the aid of the farmers, but that the business men should first complete seven miles, a mile and a half on five roads leading out of town in different directions. The business men's association at once accepted the idea, $300 was subscribed that evening which a little later became $1,800, and preparations were made for starting to work at once. The county commissioners agreed to furnish suitable waterways for every mile of road worked according to the standard adopted.

These seven miles were completed in 1909. Every farmer coming into the town had three miles of good roads, 1 1-2 miles each way. They quickly saw the advantage and became interested in the movement.

The 1910 work was started with a smoker given by the association. The farmers living inside of this square were invited. A large number attended. The association offered ten cash prizes to be awarded by judges chosen by those present. The judges were instructed to survey all miles pledged before the work began, and again in November, and were to give credit only for transformation toward the standard of road adopted.

This standard was:

1. Road bed 40 feet wide, sufficiently crowned for perfect drainage, avoiding a pointed center.

2. Fill over waterways to a level with base of elevation on either side, and sufficient to protect concrete.

3. Curbs 20 feet from center of road, and to be cut straight, gutters to drain perfectly.

4. The surface to be smooth when finished.

5 and 6. Cuts and fills each to be considered by the judges who give credit for the greatest transformation of road.

Twenty-three miles of roads were pledged by the farmers. Men who were called overseers were placed in charge of each mile, and their neighbors who assisted them were called helpers.

After the roads had been judged, all overseers and helpers were invited to a banquet in the fall, by the association. One hundred and sixty were present. The prizes were awarded. One mile was considered the unit. Nothing less was considered. Score cards had been prepared, which showed the marking for each kind of work, fill, grade, cut, drainage, curb, surface, and suggestions for improvement by the examiners.

The work in 1911 was begun in the same way as in 1910, with a smoker.

Calendar of Coming Events

Catalogue of Future Happenings in the Automobile World That Will Help the Reader Keep His Dates Straight—Shows, Race Meets, Runs, Hill Climbs and Other Events.

Shows and Exhibitions.

May 1-6.......... Burlington, Vt., First Annual Show.

Race Meets, Runs, Hill-Climbs, Etc.

Date indefinite.....Oakland, Cal., Track Races, Oakland Motordrome.
Date indefinite.....Shreveport, La., Track Races.
May ....Lancaster, Pa., Three-Day Endurance Run, Lancaster County Auto Trade Association.
May 5-8............Los Angeles, Cal., Reliability Run, Los Angeles *Times.*
May 9-11..........Savannah, Ga., to Charlotte, N. C., Reliability Contest, Savannah Automobile Club.
May 13-14.........Latonia, Ky., Track Meet, Cincinnati Auto Dealers' Association.
May 16-19.........Washington, D. C., Four-Leaf Clover Endurance Run. Automobile Club of Washington.
May 25.............Chicago, Ill., Fuel Economy Test, Chicago Motor Club.
May 27-31.........Chicago, Ill., Five-Day Tour to Indianapolis, Chicago Automobile Club.
May 29-31.........Chicago, Ill., Tour to Indianapolis, Chicago Motor Club.
May 30.............St. Louis, Mo., Reliability Run, Missouri State Automobile Association.
May 30.............Indianapolis, Ind., Five-Hundred-Mile International Sweepstakes Race, Motor Speedway.
June 7..............New York City, Orphans' Day.
June 15, 16, 17....Dayton, O., Midsummer Meeting Society of Automobile Engineers.
June 15-20.........Endurance Run, Cañon City, Col., to Hutchison, Kan.
June 16-20.........Des Moines, Iowa, Annual Tour, Hyperion Field and Motor Club.
June 19-25.........Glidden Tour, Washington, D. C., to Ottawa, Canada.
June 22............Algonquin Hill Climb, Chicago Motor Club.
July 1-3............Motor Contest Association's Catskill Run.
July 4..............Detroit, Annual Track Meet, Wolverine Automobile Club.
July 17-19.........Cleveland, O., Three-Day Reliability Run of the *Cleveland News.*
July 17-22.........Wisconsin Reliability Run, Wisconsin State Automobile Association.
July ....Indianapolis, Indiana Four-State Tour, Indianapolis Auto Trade Association.
Aug. 25-26........Elgin, Ill., National Stock Chassis Road Race, Chicago Motor Club.
Oct. 9-13...........Chicago, Ill., Thousand-Mile Reliability Run, Chicago Motor Club.

Foreign Fixtures.

May 1-15...........Turin, Italy, Automobile Salon.
May 7..............Sicily, Targa Florio Road Race.
May 14.............Barcelona, Spain, Catalona Cup Road Race.
May 21.............Limonest, France, Annual Hill-Climb.
May 21.............Ries, Austria, Hill-Climb.
May 25.............Meuse Hill-Climb, Belgium.
May 25.............Le Mans, France, Touring Car Kilometer Speed Trials.
May 28.............Le Mans, France, Hill-Climb for Touring Cars.
May 28.............Start of Touring Car Reliability Trials in Germany.
June 1..............Bucharest, Roumania, Speed Trials.
June 4.............. Trieste, Austria, Hill-Climb.
June 18............. Boulogne, rFance, Voiturtte and Light-Car Road Races.
June 25............. Sarthe Circuit, France, Grand Prix of Automobile Club
June 25-July 2....International Reliability Tour, Danish Automobile Club.
July 5 (to 20)..... Start of the Prince Henry Tour from Hamburg, Germany.
July 9.............. Susa-Mont Cenis Hill-Climb, Italy.
July 13-20..........Ostend, Belgium, Speed Trials.
July 21-24.......... Boulogne-sur-Mer, Race Meet.
Aug. 6..............Mont Ventoux, France, Annual Hill-Climb.
Sept. 2-11..........Roubaix, France, Agricultural Motor Vehicle Show.
Sept. 9.............. Bologna, Italy, Grand Prix of Italy.
Sept. 10-20........ Hungarian Voiturette and Small-Car Trial.

THE AUTOMOBILE

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THE CLASS JOURNAL COMPANY
H. M. SWETLAND, President
A. B. SWETLAND, General Manager
231-241 West 39th Street, New York City

EDITORIAL DEPARTMENT
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GEORGE M. SCHELL, Associate Editor
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APPALLING, as an expression, fails utterly to characterize a considerable number of the cape tops that are inflicted upon otherwise good automobiles. The functions of tops are to intercept the sun's rays, ward off the cold wind and keep out the rain. To obtain these advantages without detracting from the appearance of the car is the broad idea. Fastidious persons, those who would much prefer to get wet rather than to don a shabby bathing suit, would naturally carry the same idea into their dealings with the automobile; at all events, to be forced to take a bath while sitting in a car is abhorrent, and yet it is the only thing that can happen if the rain comes with nothing more to protect the person of the automobilist than one of these tops.

* * *

SPEAKING of tires, remembering that rubber loses its strength when it is heated up, and that heat has its avenue of escape, preferably through certain materials, other media acting as insulators, mindful of the considerable bill that is footed up in the purchase of tires, it remains to observe that there is one excellent point in favor of the metal wheels: if wood felloes are excluded, wood being an insulator, it follows that the heat will not be intercepted by the wood, hence it will be free to traverse from its point of generation in the molecular structure of the rubber, through the metal rim of the tire, and thence to the atmosphere, partly by absorption from the surfaces of the rim, and, for the rest, by way of the metal spokes, even down to the hub of the wheel. How to keep tires from overheating is a great and important problem. Proper inflation, if the tires are big enough for the work, is the major part of effective co-operation; it is, nevertheless, interesting to observe that wire wheels deliver an extra measure of result in this connection.

* * *

INFORMATION comes from Iowa through authentic channels, indicating that the farmers of that State paid $13,885,516 as the extra price for tolerating bad roads. The average haul to market in Iowa is 9.4 miles. The cost of hauling, per ton mile, on dirt roads is 23 cents. This cost reduces to 10 cents per ton mile on improved roads, and the difference between these two items represents the figure as herein quoted for the loss that the farmers sustained. As another angle to this important matter, it is shown that the value of Iowa land would increase by $645,408,000 as a direct result were the roads improved, and the cost to the State of Iowa for this improvement would be a mere matter of $225,000,000.

* * *

STANDARDIZATION is a term that is being misquoted broadcast in automobile circles, in the haunts of the makers, where users congregate, and among those who speculate on the future of the automobile industry, despite the fact that its status up to the present time shows no earmarks to which they can lay claim. A constructive policy is all that can result from standardization, and if the industry is to progress along classified lines it is the mistakes that will have to be standardized, in other words recognized, so that they may be laid upon a shelf in order that the dust of ages will cover them up, protecting the unsophisticated from their wiles. In thus proceeding, there will be no handicap laid upon the automobile industry; progress will not be anchored to a fixed spot on the face of time, and the growth of improvement will shine with the luster of its well-groomed keep without a freckle of imperfection to mar its face. The banner of evolution waves over the automobile industry; it has been nailed to the mast by a far-reaching hand, and every builder of automobiles who may be infected with the virus that tells him to join the "stand-patters" will be able to see at a glance if he looks at this banner that it is an emblem of intelligent progressive work, and it is a part of the evolutionary process of classifying evils and putting them away.

* * *

CONFIDENCE is lacking in every enterprise as this commodity is doled out by the suspicious and sinister mind. But the world is not the handiwork of the sinister. Things are not accomplished by the texture of the brain that looks with suspicion upon every object that animates. The difference between the antics of a jungle-tiger and a well-balanced man lies absolutely in the ego. The man who suspects others has very little confidence in himself, and it is his misfortune that he is suspected by right-minded people just in proportion as he fails to accept things at their conceded face value. In the purchase of an automobile, for illustration, there is a great difference between showing appreciation of the good and the ordinary as these qualities are distributed, and going about with an exaggerated ego, presenting the sinister side and generating effective opposition.

Big Merger of Trade Papers

A LARGE and important merger of class journals was completed on May 1 by the formation of a $7,500,000 holding company, called the United Publishers Corporation, to take over three groups of trade publications, most of them in New York. These are an iron and steel unit, represented by the publications of the David Williams Company, including *Iron Age, Iron Age Hardware, The Metal Worker* and *The Building Age;* a dry goods unit, represented by the publications of the Root Securities Company, and including *The Dry Goods Economist, The Drygoodsman, The Dry Goods Reporter, The Boot and Shoe Recorder,* and other papers; and an automobile unit, represented by the Class Journal Company, and including THE AUTOMOBILE, *The Motor Age, The Commercial Vehicle* and the *Blue Book.* Nearly all of these are published in New York. *The Boot and Shoe Recorder* is published in Boston, and *The Motor Age* in Chicago.

The organization has been brought about by I. A. Mekeel, of the Root Securities Company, who has associated with him Condé Nast, of *Vogue, House and Garden* and *The Travel Magazine.* These magazines are not included in the merger, which is purely a trade paper organization.

The directors of the new corporation are, besides Messrs. Mekeel and Nast, Charles T. Root, who is the president; H. M. Swetland, Charles G. Phillips and W. H. Taylor.

Mr. Root is president of the Root Securities Company and of the David Williams Company. Mr. Phillips is associated with Mr. Root in the management of these properties.

Mr. Swetland is president of the Class Journal Company and of the Federal Printing Company. Besides his present holdings, he has in the past owned a number of different trade papers.

Mr. Taylor is treasurer and general manager of the *Iron Age.*

All of the publications, with the exceptions noted, are now housed under one roof in the Publishers' Building, at 239 West Thirty-ninth street, which is owned by another company, in which the same interests are represented, and are being printed by the Federal Printing Company, which occupies several floors in the same building. The *Iron Age* has only lately been moved up from Park Place, but has one of the handsomest sets of offices.

The co-operative arrangement between the various members of the present merger has been growing from year to year, and is now carried to its logical conclusion by placing the stock of the three companies in a holding company. The union is to secure economy, uniformity and permanency of policy and does not imply any change in the business and editorial management of the various publications mentioned. Each will continue separate, as before, and develop along its own lines, while profiting from the infusion of new blood and new ideas.

Large economies have already been effected by the closer physical grouping of the properties. The same storehouses and stockrooms serve for all, and the same printing plant, which is entirely modern in every respect, and so complete that even the stocks and bonds needed for the merger are being engraved and printed on the premises. A decidedly increased efficiency is made possible by the merger, for example, in the purchase of paper stock, ink and other supplies and in the conduct of agencies in other cities. This was one of the main arguments for closer union.

Another cogent reason was the desire on the part of the younger element in the organization to develop the enterprises to still greater possibilities.

The resulting organization is a close corporation—a publishers' organization, as the name implies. The voting power is vested in a voting trust of three, and the management in the directors.

As soon as the arrangements for the merger were completed, about the middle of March, Messrs. Root and Phillips left for a trip around the world.

An interesting feature of the merger is Mr. Nast's connection with it. He has not heretofore entered the trade journal field, and the extent of his activity remains to be seen. That the enterprise will derive great benefit from his association with it is assured.

At the stockholders' meeting of the Class Journal Company held May 2d the following were elected directors for the ensuing year: H. M. Swetland, A. B. Swetland, E. M. Corey, N. H. Van Sicklen, Jr., and Condé Nast. After the stockholders' meeting the newly elected directors convened and elected officers for the ensuing year, as follows: H. M. Swetland, president; A. B. Swetland, vice-president and general manager; E. M. Corey, secretary and treasurer.

Grand Circuit Train Abandoned

NEW YORK, May 3—There will be no Grand Circuit Automobile Racing Train this year at any rate. The project has been abandoned and late this afternoon the various interests represented will meet to give the plan its quietus. The Manufacturers' Contest Association is preparing a statement to the industry telling the reasons for the abandonment of the idea.

The abandonment of the train idea will not affect the sporting situation save that it has caused delay in the announcement of sporting dates all over the country. This announcement will be made in the near future. The facts in the case are that the makers of automobiles figured that the cost of the train would prove out of proportion to the benefits to be derived.

Glidden Pathfinder Nearing Goal

MONTREAL, CAN., May 3—Latest reports from the Glidden pathfinding party are that the Stevens-Duryea car carrying the routemakers for this year's tour will reach here to-day. Chairman Butler of the Contest Board returned to New York on Tuesday, leaving the party in Vermont after an inspection of three or four hills, upon one of which the hill-climb that will be a feature of the fifth day of the tour will be held.

The particular hill has not been definitely selected. Mr. Butler says that the roads are in excellent condition for this period of the spring season and that when the tour is made they will be well-nigh perfect.

The party expects to be in Ottawa on Saturday, when the Governor-General will formally receive and entertain the members at dinner.

Repairmen Strike for Short Day

Quite a number of automobile repairmen employed in some of the New York garages and repair departments are on strike. They went out suddenly on Wednesday and in a few cases their absence from their benches caused a tie-up of the establishments.

The matter at issue is the granting of an eight-hour day with full-time pay. In many of the shops the working day is nine hours and in a few of them eight and one-half hours is considered a day. Several of the larger shops were not affected in any way by the move.

Quakers Enjoy Social Run

Fourth in the annual series of social runs from Philadelphia to Atlantic City under the auspices of the Quaker City Motor Club was the event that was conducted last Saturday afternoon. Like the other runs of the kind, speed alone was not a factor in the final result, as the awards were based upon approximating a secret time. An enjoyable time was experienced and the affair proved to be entirely successful.

ATLANTIC CITY, N. J., April 30—L. D. Berger, president of the Quaker City Motor Club, in a Columbia car, Harry Walls driver, proved to be the best gauger of time for the 73 miles in the club's fourth annual social run to this resort, his car finishing within 24 seconds of the official sealed time, 3 hours, 46 minutes, 16 seconds, President Berger's time being 3 hours, 46 minutes, 40 seconds. He thus carries off the first prize, a handsome mahogany clock. Second prize, the Hotel Strand silver cup, goes to G. Hilton Gantert, in a Stearns, Mr. Gantert driving, his estimation being 1 minute 8 seconds slower than the secret time allowance. Mr. Gantert is also an official of the Quaker City Motor Club, being a member of the board of governors. Third prize, likewise a silver cup, was captured by O. C. Feil, Packard car, H. Van Fesson driver, who negotiated the distance 1 minute 13 seconds too soon. Still another officer of the Quaker City Motor Club ran away with a prize, the fourth, First Vice-President J. Fred Betz, 3d, giving his Simplex, finishing fourth, 1 minute 14 4-5 seconds away. Fifth prize was a beautiful decanter set, which will henceforth be the property of Joe Keir, driving a Mitchell, and who finished 1 minute 16 seconds fast.

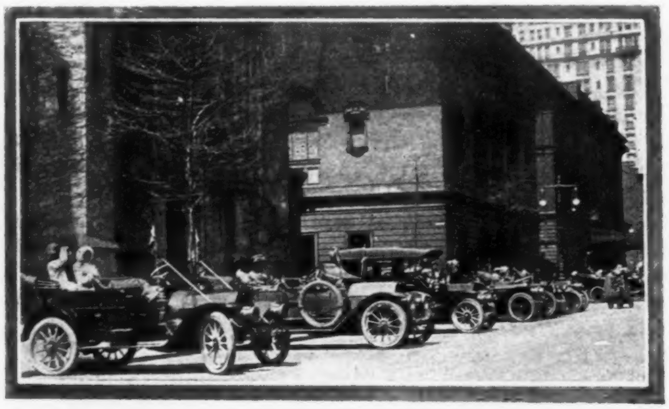
The times made by the five winners were variously: President L. D. Berger, 3:46:40; G. Hilton Gantert, 3:47:24; Otto C. Feil, 3:45:03; J. Fred Betz, 3d, 3:47:30 4-5; Joseph Keir, 3:45:00.

The prize confined strictly to lady drivers was the object of more than ordinary interest and speculation, this feature proving a most popular innovation on the part of the club officials. Miss Emma Hardart outguessed her fair competitors by piloting a Winton in 3 hours 50 minutes 50 seconds, being 4 minutes 34 seconds slower than the official time. Mrs. Edward Wilkie in a Buick, finished second, Mrs. D. Walter Harper third and Miss May Hardart fourth.

By all odds the run was the most successful so far of this yearly feature of the Quaker City Motor Club. The day was a well-nigh perfect one and the running conditions excellent, everything going through as originally planned, a combination productive of a most enjoyable event. A large crowd assembled around the Hotel Walton shortly before the start, and the cars gaily bedecked with pennants bearing "Q. C. M. C." and the number of the car in blue letters on a yellow ground presented a handsome appearance and excited much interest.

Scene at the start of the Fourth Annual Roadability Run of the Quaker City Motor Club to Atlantic City

The cars were lined up on both sides of Broad street, extending south from the Walton, each in its allotted space, the street being chalked off into spaces with figures corresponding to the number of the car to occupy same. The first car was sent on its journey promptly at 12.30, the others following at half-minute intervals. A Kissel-Kar truck preceded the participants, conveying their baggage to the resort. Two cars containing the Timers' and Scorers' Club also made an early start. It was a question of merely feeling the way down Market street to the ferry, and it was not until the Jersey side was reached that the real start was made and the cars struck their natural clip. Being a social run and not in any respect in the nature of a speeding contest, the cars were driven at uniform speed, with a definite time limit set by each driver, all mathematically planned in advance and in most cases rigidly adhered to. Checkers were stationed at Pleasantville.



Before the start—contestants lining up on the west side of Broad Street, opposite the Quakers' club-house

The regulations under which the run was conducted were practically identical with those of last year, a system originated and perfected by Harry C. Harbach, former secretary of the Quaker City Motor Club, and by which ties are virtually eliminated.

The official time was unknown to any one and was determined by an average struck from two times designated by the mayors of Philadelphia and Atlantic City. Mayor Reyburn, of Philadelphia, set the time at 3 hours 51 minutes 13 seconds, while that of Mayor Stoy, of Atlantic City, was 3 hours 41 minutes 19 seconds. The two times were added together and divided by 2, fixing the official time at 3 hours 46 minutes 16 seconds.

A particularly happy route, partially a new one, had been mapped out by Pathfinder George E. Potts, the roads selected being uniformly good, with a corresponding degree of comfort and enjoyableness.

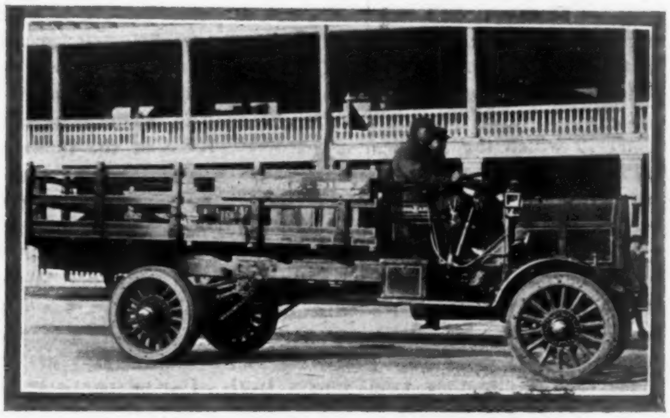
All but one of the cars arrived safely, tire trouble on quite a few being the only cause of delay. Upon checking in here at the Strand the cars were driven to Young's Million Dollar Pier, where they were parked for the night and where they were constantly surrounded by curious and interested crowds. This morning saw the departure of several of the cars at varying intervals for Philadelphia, the time of leaving being optional with the motorists, as the run proper ended with the checking in of participants yesterday. A goodly number were loth to leave to-day and will postpone their return till Monday.

Announcement was made that the distribution of the trophies

to the winners will be made in the club rooms, Hotel Walton, on Tuesday evening at 8 o'clock.

Following is the list of competing cars with name of driver and the time:

Car	Owner	Driver	Time
Columbia	L. D. Berger	Harry Walls	3:46:40⅘
Packard	P. D. Folwell	P. D. Folwell	3:53:30⅘
Woods Electric	J. C. Bartlett	J. C. Bartlett	4:29:26
Simplex	J. Fred Betz, 3d	J. Fred. Betz, 3d	3:47:30.8
Bergdoll	E. H. Lewis	E. H. Lewis	3:51:32.7
Winton	George E. Potts	Ralph James	3:28:01
White Gas Car	A. T. James	A. T. James	4:21:22.2
Stearns	G. H. Gantert	G. H. Gantert	3:47:24
White Gas Car	Evans Church	Evans Church	3:54:35⅘
Woods Electric	J. C. Bartlett	Mrs. J. C. Bartlett	Not finished
Otto	E. B. Morgan	E. B. Morgan	4:07:37
Oldsmobile	A. E. Adams	A. E. Adams	3:33:33
Winton	F. Hardart	Miss E. Hardart	3:50:50
Stevens-Duryea	F. B. Hitchcock	F. B. Hitchcock	4:03:05
Elmore	F. Hardart	F. Hardart	4:03:04
Packard	Otto C. Feil	H. Van Fesson	3:45:03
Winton	J. L. Brock	J. L. Brock	3:52:33⅘
Mitchell	Joe Keir	Joe Keir	3:45
Chadwick	Ralph Murray	H. Murray	4:08:01
White	C. E. Carpenter	H. Morham	3:48:15
Buick	E. Wilkie	E. Wilkie	4:00
Kissel	Motor Dist. Co.	W. Miller	4:01:11
Maxwell	M. B. Ogle	H. Ogle Krause	3:52:00
Oldsmobile	Edward Rush, Jr.	Edward Rush, Jr.	4:15:22
American Traveler	J. R. Mountain	J. R. Mountain	3:51
Mora	Harry Jacobs	Harry Jacobs	3:51:20
National	John B. Mayer	H. Schroeder	3:54:15
Locomobile	Frank Shaw	Frank Shaw	3:50:30
Reo	D. E. McAllister	D. E. McAllister	3:50:50



The huge Kissel-Kar truck, which covered the course in the Quaker City Club Run in 3 hours, 51 minutes

Car	Owner	Driver	Time
Packard	Jack Scanlon	Jack Scanlon	3:12:25
Columbia	United Motor Co.	C. Reeves	3:53:33
Haynes	E. B. Stone	E. B. Stone	4:01:58
Pullman	Longstreth Motor Co.	W. C. Longstreth	3:52:33
White	E. W. Taxis	W. E. Taxis	3:54:21
Washington	Whitman and Shutt	O. H. Whitman	Not marked
White	John Eagleson	A. Bigelow	3:15:15
Chalmers-Detroit	F. France	F. France	3:50:01
Kline Meteor	J. M. Canfield	H. Stevenson	3:48:29½
White	I. W. Bickley	A. L. Walton	3:14:11⅘
Peerless	W. E. Dotts	R. A. Loughney	4:08
Hupmobile	G. P. Canning	Miss M. R. Van Note	4:28:50
Rainier	J. W. Siemons	J. L. Siemons	4:05
Fiat	E. J. McNichol	E. J. McNichol	3:49:08
Simplex	J. McNichol	J. McNichol	3:57:42
Simplex	Frank McNichol	Frank McNichol	3:52:48
Bergdoll	E. C. Johnson	E. C. Johnson	3:41:12
Mora	Mora Motor Co.	William P. Fleming	3:53:48
Delaunay-Belleville	Max Strozzi	Max Strozzi	3:48:25
Bergdoll	E. L. Carr	E. L. Carr	3:39
Stanley Steamer	Mrs. D. W. Harper	Mrs. D. W. Harper	3:29:13
Oldsmobile	Joseph Beig	Joseph Beig	4:31:32
Buick	R. H. Grigg	R. H. Grigg	4:09:15
Chadwick	C. P. Sanders, Jr.	C. P. Sanders, Jr.	3:49:29

New York Members of S. A. E. Meet

Members of the Metropolitan Section of the S. A. E. held their second meeting April 27, at the headquarters of the organization. A paper by N. B. Pope on "Devices for Fire Protection on Automobiles" was the feature of the formal session. He showed from statistics of British fire departments that the automobile is not a particularly hazardous risk and that the rates of insurance charged were apparently too high.

The idea of periodical meetings of members of the S. A. E. living in or near such cities as New York, Philadelphia, Indianapolis, Detroit and other important centers of the automobile industry was further discussed and recommended. Several steps looking toward the perfection of sectional organizations were taken, the general impression being that such organizations would prove to be advantageous.

Tires formed the subject of a discussion toward the close of the New York meeting.

New York Orphans to Ride June 7

One of the most beautiful functions of motordom is the annual "Orphans' Day" joy ride tendered to the little ones who have been so unfortunate as to miss the comforts of home and the protection of parental breadwinners. It has been the custom to give these orphans an automobile ride once a year and in the past these rides and the entertainment furnished the children at Coney Island have proved eminently successful.

This year the ride will take place June 7 and it is planned to have it much larger in point of numbers and general enjoyability than ever before. Col. K. C. Pardee is president.

Y. M. C. A. to Train Firemen

To train competent men to handle motor-driven fire engines and other apparatus, the West Side Y. M. C. A. has inaugurated a special course in its automobile school. A particular effort is being made to interest members of the fire department in the course, which is so arranged that the men can attend the lectures on their days off. Shop and road work are included.

L. I. A. C. to Entertain Ladies

One of the most enjoyable functions of the Long Island Automobile Club will take place on the evening of May 4 when Ladies' Night Entertainment will be given at the club house of the organization. A delightful musical program has been arranged and a dainty luncheon will be served.

Reeves Given a Wine Service

Associates of Alfred Reeves when he was connected with the A. L. A. M. presented him with a silver wine service on Saturday when he was about to part from them to take charge of the selling department of the United States Motor Company. Mr. Reeves assumed his new duties on Monday.

The contestants in the Quaker City run lining up in front of the Hotel Strand, Atlantic City, after finishing

Simplex Overtops Card

Three so-called races, an exhibition ten miles by Bruce-Brown and a series of mile trials were run off at Guttenberg Saturday as the opening of the metropolitan automobile racing season. The track was in execrable condition with ruts and dust and the sport was very mediocre. Two big Simplex cars made a show of the ancient cars pitted against them and there was nothing like a contest developed in the racing and fortunately no fatalities.

OPENING the metropolitan automobile racing season for 1911, a meeting was held Saturday at the ancient Guttenberg track which attracted almost 2,000 sport-hungry motorists. There were three races carded, an exhibition by Bruce-Brown and a series of mile time trials.

The less said about the races, the better, as a pair of high-powered Simplex cars robbed those events of any interest they might have presented by overshadowing the fields. They finished one, two in both races in which they competed, lapping their fields whenever the drivers willed.

There was not the semblance of a tight fit throughout the program and it is fortunate that such a condition obtained. The track was frankly unfit for speed and only one driver took the least chance during the races. The running of the events was well-handled and the contestants were warned before the start of the first race that two of the turns were in man-killing condition. The dust raised by the cars was impenetrable and no effort was made before the races to correct it. Most of the cars entered were clearly entitled to honorable retirement; for instance, a Peerless car of 1905 tried to go in the first race with the result that it shed a few wheels on the stable turn. Luckily the crew escaped injury. Another veteran, a Hotchkiss of 1907, managed to stay on the track throughout one event, but was far away out of the money at the end.

There was strong doubt about the delivery of a sanction from the Contest Board until just before post time in the first race. Mr. Schumaker, of the Contest Board, was on the scene early and threatened to withhold the sanction unless the turns were made safer and insisted that the entrants observe care in making the circuit. This was reflected in the slow time and absence of fatalities. The summary:

Three Miles: Class E, Under 300 Cubic Inches.

Number.	Car.	Driver.	Place.	Time.
7	S. P. O.	Robinson	1	3:52 2-5
2	E-M-F	Rouse	2	......
10	Chalmers	De Hart	3	......
12	Lancia	Ferguson	4	......
14	Palmer-Singer	Cobe	5	......
8	Hudson	Moller	No finish	......
		Five Miles: Class E.		
2	Simplex	De Palma	1	5:20 4-5
4	Simplex	Ormsby	2	......
15	Hotchkiss	Kilpatrick	3	......
14	Palmer-Singer	Cobe		
1	Peerless	Gilhooly	..	No time taken
	Ten Mile Exhibition:	**Fiat (Bruce-Brown)**	**Mile Trials.**	
2	Simplex	De Palma	..	0:59 2-5
21	Pullman	Rouse	..	1:19
14	Palmer-Singer	Cobe	..	1:18 4-5
7	S.P.O.	Robinson	..	1:12
4	Simplex	Ormsby	..	1:00 4-5
		Ten Miles: Class D		
2	Simplex	De Palma	1	10:13 2-5
4	Simplex	Ormsby	2	......
7	S.P.O.	Robinson	3	......
14	Palmer-Singer	Cobe	4	......

Wisconsin Reliability July 17

MILWAUKEE, May 1—The second annual reliability tour of the Wisconsin State Automobile Association will start on July 17, 1911, and end on July 22, according to announcement just made by the Contest Board. The route blazed by M. C. Moore, president of the association, and pathfinder and pilot for all tours held by the association, will be reviewed in a second tour beginning Monday, May 15, in an Overland, driven by George W. Browne, Wisconsin factory representative of the Willys-Overland Co., of Toledo.

Mixed Run for Missourians

ST. LOUIS, May 1—Entry blanks will be sent out this week for the first run to be held by the newly organized Missouri State Automobile Association, May 30. According to plans ratified at a recent meeting of the association, there will be two pleasure car divisions for gasoline cars, one for electrics, and a division for trucks. One of the gasoline pleasure car divisions will be for dealers and the other for owners.

There will be four classes:—First class for cars costing up to and including $1,000; second class, $1,001 up to and including $2,000; third class, $2,001 up to and including $3,000; fourth class, $3,001 and up. The course is 347 miles in St. Louis county. The entry fee for dealers is to be $5 and $2 for owners.

Gasoline Fire Quenched in 30 Seconds

FOLLOWING the experiments that were made last week by Chief Thomas Lally, N. Y. F. D., Brooklyn, a further demonstration of the idea of putting out gasoline fires with chemicals was tried out at the plant of the Standard Oil Company, in Brooklyn, in the presence of the "Chief" and a staff of experts, with great success. The plan is being perfected for use in the oil company's plant and the installation comprises, in addition to the necessary fire pump, two tanks of a combined capacity of 38,000 pounds of the chemical in addition to the water in which the chemical is dissolved. One of the tanks is used for a solution of aluminum sulphate and licorice in the proportion of 18,000 pounds of aluminum to 8,000 pounds of the licorice and the remaining tank holds 12,000 pounds of bicarbonate of soda. When a fire starts in a gasoline tank all that has to be done is to start the fire pumps and open the valves of the piping that leads to the offending tank, to put out the fire. In the working of this system the two solutions are mingled as they are forced into the pipe line and as they arrive at the tank-on-fire they swell into a froth of some consistency, spread across the surface of the burning liquid, separating the liquid from the air, putting out the fire.

In an actual trial in a tank holding gasoline at the works to-day, it was found that a fierce blaze of this character was put out in the small space of 30 seconds. This trial was repeated four times, and according to the "Fire Chief," it is now an assured fact that fires due to gasoline, under this system, may be put out with certainty, whereas, using water, nothing would happen but to spread the flame and add to the havoc. It may take a little time to revamp a system of this character so that it will work efficaciously in garages, but the time must come soon when risks of this nature will be handled on a scientific basis.

To Start Road Work in Maryland

BALTIMORE, May 1—As a starter on the good roads work to be done this summer under the auspices of the Good Roads Commission of Maryland, that commission has advertised for sealed proposals for building 20 sections of State highways, aggregating 57.10 miles, and one concrete bridge. The counties in which this work is to be done and the roads to be improved are as follows:

Anne Arundel County—One section along Light street, Brooklyn, 31-100 miles; one section from Mount Zion to Birsville, 5 miles, and three sections along the Annapolis Boulevard, from the end of Section 1 to Revell, a distance of 1.82 miles; from Boone to the Magothy River, 3.07 miles; from Magothy River to Glenburnie, 5.27 miles. Baltimore County—State Road No. 1, Section 13, from Patapsco River to the Baltimore & Ohio Railroad, crossing near Halethorp, 80-100 miles; State Road No. 1, Section 15 A. B. 2, from Baltimore & Ohio Railroad, crossing

near Mt. Winans to Catons avenue, 1.57 miles. Calvert County—About 4.26 miles on the road between Owings and Prince Frederick. Carroll County—About 5.29 miles along the road between Gamber and Fenby. Charles County—About 3.01 miles along the road from Waldorf to the St. Mary's county line. Dorchester County—About 4.39 miles along the road from Shiloh to Brookview. Frederick County—One section along the Monrovia to Kempton road, 1.20 miles, and one section from New Market to New London, 3 miles. Garrett County—One section between McHenry and Accident, 4.39 miles, and one section from the Allegany County line to Piney Grove, 4.18 miles. Montgomery County—Concrete bridge over Rock Creek. Prince George's County—One section from the District of Columbia line to the Charles County line, 6 miles; two sections along State Road No. 1, Section 10, near Paint Branch, 36-100 mile, and Section 14 B, through Bradensburg, 47-100 mile, Queen Anne's County—One section from Centreville to Wye Mills, 2.50 miles, and one section at Wye Mills, 22-100 mile.

Atlantic City as Trade Field

Atlantic City, N. J., May 1—This resort, noted for its diversified attractions, is rapidly assuming healthy proportions in the automobile trade, conditions being unusually active and sales being more numerous than ever. Salesmen and representatives of agencies for both gasoline pleasure cars and motor trucks report handsome increases over former seasons.

Of course, this town has always been a Mecca for tourists, but as a trade center it has hitherto remained in a lethargic state and it is only comparatively recently that its possibilities as a trade center have been fully appreciated. The field is a wide one, Atlantic City being the logical center for all of the South Jersey towns and cities.

Sioux City-Yankton Road Planned

Sioux City, Ia., May 1—A highway extending from Sioux City, Ia., to Yankton, S. D., is a project now being worked upon by people in towns along the way who are interested in it. If sufficient interest can be aroused it is planned to have Sioux Cityans maintain the road from Sioux City to McCook. From there Jefferson would take the road half way from Jefferson to Elk Point, the latter city half way to Burbank, and residents of Burbank to bring it to their own town. Vermillion would be expected to handle it from Burbank to Meckling, while the people of Meckling, Gayville and Yankton would be expected to complete the highway.

To Market Vanadium Products

Under the title of the Universal Vanadium Co., the recently organized Delaware corporation has elected the following officers: Edward M. McIlvain, president; Millard Hunsiker, vice-president; James C. Gray, secretary and treasurer, and a number of foreign and domestic representatives. The purpose of the new concern is to act as selling agent for the American Vanadium Co. in conjunction with the Vanadium Sales Co. of America.

Syracuse Club Gives Yearly Banquet

Syracuse, N. Y., May 1—The eighth annual banquet of the Automobile Club of Syracuse, held at The Onondaga Thursday night, was the most successful affair of its kind the organization has ever given. The guests, 350 in number, included prominent residents of many cities and towns in central New York, in addition to many members of the home club, which now numbers over 600 and whose slogan, adopted at Thursday's banquet, is now: "1,000 members before the start of 1912."

A novelty was a tollgate erected at the entrance to the large dining hall, which was adorned with signs denoting the club's attitude toward the tollgate situation in this section.

The decorations were handsome. The great hall was draped with the club's colors and a large banner appeared over the speakers' table with the legend, "Automobile Club of Syracuse." The balcony which held the musicians was handsomely decorated with palms.

The banquet committee was composed of President H. W. Smith, Dean E. Brown, Nelson C. Hyde, Secretary Forman Wilkinson and Howard P. Denison.

Scene at the eighth annual banquet of the Automobile Club of Syracuse, held at the Onondaga on April 27th.

Largest Steam Hammer Installed

MILWAUKEE May 1—The largest steam hammer ever constructed in America has just been installed in the mammoth plant of the A. O. Smith Company, at Keefe avenue and Hopkins street, Milwaukee, Wis. It will be used for forging axles and shafts.

The Smith Company makes, approximately, 60 per cent. of all pressed steel frames used in motor car construction at this time. The new hammer is 29 feet high, set on a solid concrete foundation 8 1-2 feet below the surface. The ram weighs 16,000 pounds and delivers a blow of 1,600,000 pounds. The anvil block weighs 188,000 pounds and is probably the largest solid block of metal ever fabricated. The hammer is the product of the Chambersburg Engineering Company, of Chambersburg, Pa.

The only cast iron part is the steam cylinder, which has a bore of 24 inches and stroke of 52 inches, the remainder being entirely of steel. The Smith Company is experiencing one of the busiest periods since its establishment and both of its large plants at Milwaukee are working at capacity.

Changes in Cleveland Field

CLEVELAND, O., May 1—Several important changes have taken place in agents, sales forces and location of sales rooms in Cleveland during the past two weeks in preparation for the summer selling months. The Ford Motor Co.'s Cleveland branch moved on May 1 to its new building at 4400 Euclid avenue. The new quarters form one of the most complete automobile establishments in the State. The Goodyear Rubber & Tire Co. has moved to its more commodious salesrooms in the Spencerian building. The Kelley Springfield Tire Co. is planning to open a new salesroom in the Kennedy block, Euclid avenue and E. Nineteenth street.

J. O. Hahn, connected with the Studebaker Co. here, has been temporarily released by Manager A. R. Davis. He will accompany the E-M-F moving picture outfit which will visit agents between Cleveland and San Francisco for demonstration purposes. The Motor Tire & Rubber Co. has been organized under the laws of Ohio with a capital of $10,000. E. C. Anderson is the president and general manager. The company has the agency for Miller tires and several other auto accessories in the rubber line. The Thompson Oil Co. has taken larger offices at 507 Schofield building. R. S. Donaldson will have complete charge of the enlarged selling force. The Leitz Motor Car Co., of Wyandotte, Mich., will shortly open a branch here, probably in "Automobile Row." The Columbus Buggy Co. has moved to its new quarters and is running to its full capacity with a payroll of $2,000 a day.


A sample of the roads encountered by the Motorette in Mississippi

Harry S. Johnson, former secretary of the Cleveland Automobile Club, has resigned his office to take a position with Olds-Oakland Co. George Buttner, well known in local automobile circles, has also taken a position with the same company. The Parrish Motor Car Co. has succeeded the Standard Motor Car Co. as Packard agent in Cleveland. he agency is located temporarily at 5017 Euclid avenue, but a new building, including salesrooms, offices, garage, repairs shops and other departments is being planned. H. E. Stowell, a technical expert, has been sent here from the factory in the capacity of superintendent. He will have entire charge of the Packard "service." W. J. Parish is the manager of the agency.

Herbert Ash, of Fostoria, O., has come here to take charge of the Abbott Sales Co., as general manager. Headquarters are located at Euclid avenue and East Nineteenth street, and are being rearranged and re-decorated throughout. Albert W. Woodruff, who for the past year has been selling cars for the Stearns Co., has severed his connections with that firm and is now in charge of the city sales of the Consolidated Motor Car Co. He will handle the Croxton and Royal Tourist cars in this vicinity. He has been identified with the automobile business for the past five years. L. H. Zittel, who has been connected for the past few years with the Brush factory, is now associated with Manager McClure in Cleveland. He will have charge of the Brush department.

Otto Weining has opened a repair shop on the second floor of the building occupied by the Buckeye garage, 6010 Euclid avenue.


Pierce-Arrow 5-ton truck that hung suspended on its right front and left rear wheels over night, while loaded to its full capacity

Some roads traversed by the Motorette were little more than swamp paths

Motorette Meets Bad Roads in South

Late advices from the Motorette, now en route across the continent, say that the Hartford three-wheeler is now in Mississippi and is encountering road conditions that are past all descriptive effort. The accompanying illustrations will convey a faint idea of the difficulties the car and its crew have been meeting with in the South.

Utica Sees Its First Show

SYRACUSE, N. Y., May 1—Many Syracuse people took occasion this week to visit Utica's first automobile show, which was given in the Armory of that city and which opened on Wednesday night. The show, promoted by Louis Blumenstein, was a success.

The decorations of the Armory were unique. A combination of blue, pink and white bunting concealed the structural iron work and the side walls. The installation of a blue "ceiling" across the middle part of the building added much to the beauty of the effect. The booths were partitioned by jardinieres containing artificial flowers.

A list of the cars, with the exhibitors, follows: Stevens-Duryea, C. B. Rice, Inc.; Peerless, E. M. F., Brush, Crist Motor Car Company; Jackson, Charles H. Childs & Co.; Elmore, I. R. Gardenier; Corbin, Arthur Christian; Warren-Detroit, A. T. Williams, of Syracuse; Regal, H. A. House, of Ilion; Willoughby, Willoughby Company, of Utica. Whiting, H. K. Preston; Detroit Electric, Utica Electric Garage Company. Other makes were shown by Kilkenney & Buckley and The Ford Sales Company. There was also a large motor-cycle display.

There was a large exhibition of accessories, too. These included: Tires, by The Mohawk Tire Company; working parts of the Coleman motor wagon, by the Coleman Carriage Company; Shawmut tires, inner shoe linings, horn bulbs and metal polish, Utica Rubber Works; spark plugs, coils, etc., E. Q. Williams, Syracuse; fire extinguishers, O. J. Childs Company; auto robes, steamer shawls, Indian blankets, J. B. Wells & Son Company; Duntley pneumatic cleaners, M. E. Hooks Company; oils, Standard Oil Company; tops and wind shields, M. E. Blasier Manufacturing Company, also Oneita electric horn; portable garage, Wyckoff Lumber Company, and massage cream, Recreo Chemical Company. And when you think of it, this also is an automobile accessory.

The officers of the association are: E. A. Willoughby, president; C. B. Rice, vice-president; J. C. Whittle, treasurer, and F. E. Henebray, secretary. The total attendance approached 6,000, which exceeded expectations for an initial exhibition.

Caley Takes Another Job

CINCINNATI, O., May 1—Fred H. Caley, general manager of the Automobile Club of Cincinnati and until the first of the year Registrar of Automobiles in the office of the Secretary of State, of Ohio, has accepted the secretaryship of the Cleveland Automobile Club.

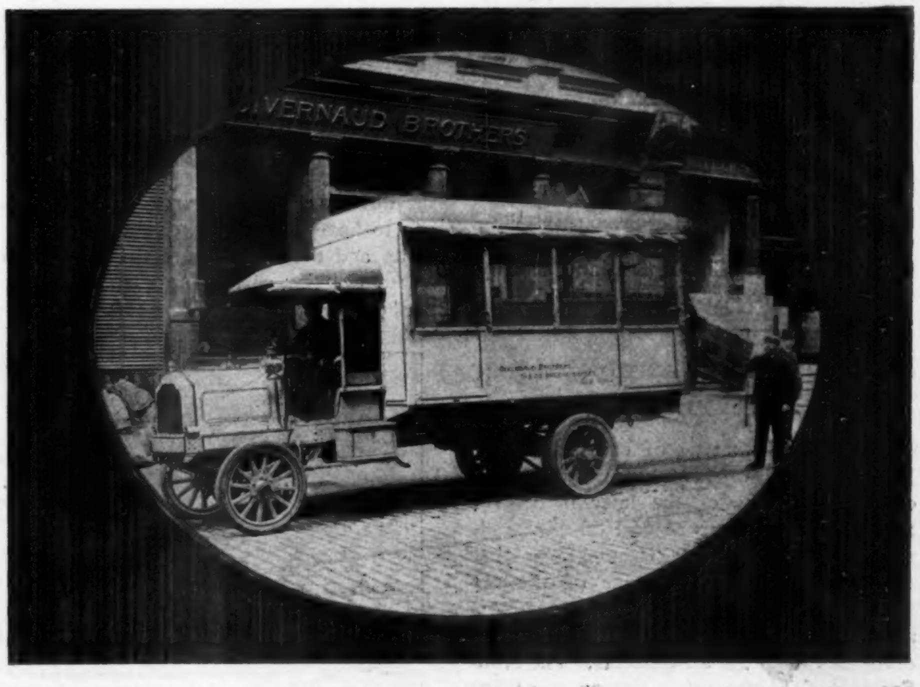
Chief of Police William Jackson to-day put into commission his new automobile. The machine is painted the "police blue" and has the coat of arms of the city on each side. Besides the regulation automobile lights it has an extra red light to be used as a signal when making a fast run.

G. W. Bennett Gains Promotion

TOLEDO, O., May 1—George W. Bennett, general sales and advertising manager of the Willys-Overland Company, has been elected to the board of directors of that company to fill the vacancy caused by the resignation of Will H. Brown, now president of the Mais Truck Company at Indianapolis. Mr. Bennett has been general sales manager for some time past.

Fiat in Its New Home on "Row"

Removing to the northeast corner of Broadway and Fifty-seventh street, the Fiat Automobile Company, on May 1, occupied its new and commodious quarters in New York. The three upper floors will be used as a repair shop, garage, storage and stock rooms.



Packard truck fitted with screen sides and drop curtains, that is now doing excellent work for a well-known New York silk house

New Things Among the Accessories

Quick Method of Removing Chains

EVERY autoist who has operated a chain-driven car has at some time found it necessary to either repair a chain or take out a link. The method employed on Baldwin roller chains is depicted in Fig. 1. The removable link C1 together with the tie bar C are shown in position with the clips L and L1 in position when the chain is on the car. The rollers R and R1 run on sleeves and through these latter the pins B and B1 pass. The bar C is held in position by small fasteners L and L1 that fit into slots in the pins. After being placed in position they are tightened by means of a pair of pliers and when it is found necessary to remove the chain for cleaning or other purposes they can be removed by means of a screwdriver. A special tool is delivered with each chain for this purpose,

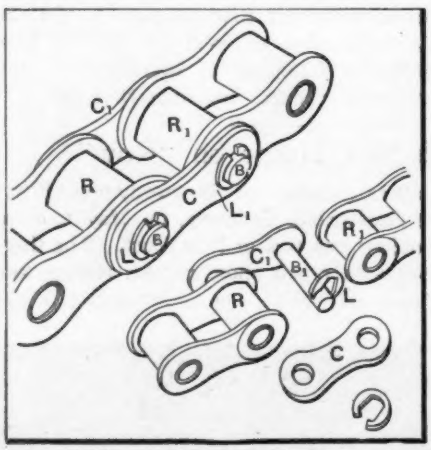


Fig. 1—Baldwin roller chains, showing the method of attaching the links

however, which facilitates the operation. These fasteners can be used several times without breaking. They are manufactured by the Baldwin Chain & Manufacturing Company, Worcester, Mass.

Fore-Doors for Unprotected Car Bodies

THE fore-door type of car has greatly increased in favor in the last year or so, and many of the later models fit these useful additions as part of the standard equipment. There is no doubt that they improve the appearance of the car and make the front seats more comfortable to ride in, protecting the legs of the occupants from the air currents. The Auto Specialty Manufacturing Company, of Indianapolis, makes a feature of supplying these for existing cars The fitting is shown in Fig. 2 and is built into its own insertable frame, this frame being designed

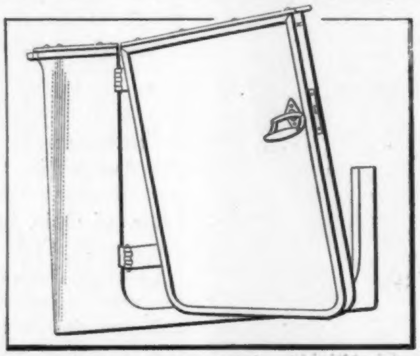


Fig. 2—Universal detachable fore-door suitable for attachment to existing cars

for the opening in the model of the car for which it is ordered. The color, striping, metal trimmings and inside finish, also the general contour, are made to harmonize with the car to which the equipment is to be added. The attaching and detaching is very simple, being effected by the use of three bolts and three screws which do not mar the appearance of the car in case it may be desired to take the doors off. These fittings are manufactured by the Auto Specialty Manufacturing Company, 326 East Market street, Indianapolis, Ind.

A Good Pump a Necessity

THE essential point of a tire pump is that it should deliver into the tire as much as possible of the air that it sucks in for each stroke of the plunger, allowing a small percentage for loss by the walls and plunger. Fig. 4 represents a vertical section through the Pitner pump and shows the different working parts. It is a necessity to have a good connection between the pump and the rubber hose that carries the air to the tire valve. At C in Fig. 4 the method employed is to use a metal union over the rubber tube which fits over a ball type socket. The tighter the union is screwed the more secure the joint becomes, and is known as the "Can't Pull Off Hose Connection." The piston is fitted with a leather ring R which has an air space at the back and is open at the lower side of the piston. With an increase of air pressure there is a tendency for this ring to press tighter against the cylinder. The air is forced through the holes O to the hose and tire. As soon as the piston passes these holes the escape of air is stopped and an air cushion is formed in A, preventing the plunger from jarring on the bottom of the pump. As it is necessary to oil the pump from time to time provision is made for this and a felt pad is fitted below A to absorb the surplus oil and so prevent it from finding its way into the tire. The

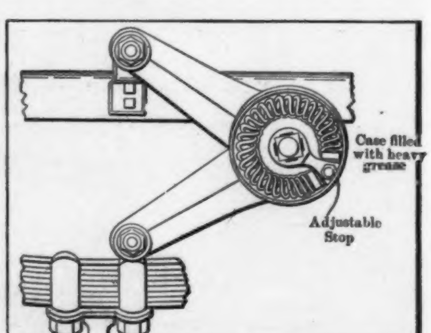


Fig. 3—View of the Penfield Shock Absorber with the dust cap removed

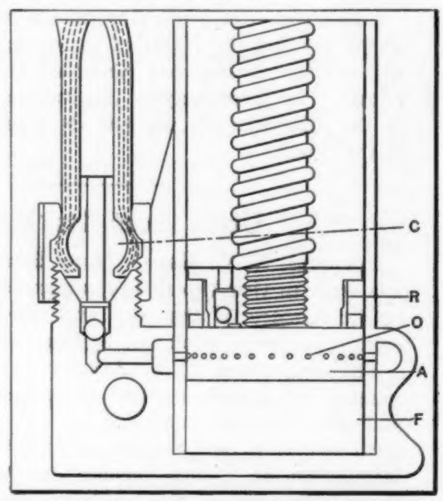


Fig. 4—Sectional view of the Pitner tire pump, showing the different working parts

pump is manufactured by the Pitner Pump Company, 26 West Michigan street, Chicago, Ill.

Shock Absorber on Coiled Spring Principle

CONSISTING of a triple coil compensating spring enclosed in a dust-proof casing, the Penfield shock absorber has recently been placed on the market. The method of operation is seen by referring to Fig. 3. The two fulcrum arms are attached to the frame and axle respectively, and when the compression of the spring takes place, the coil spring is tightened, thereby placing a resistance against the car springs. It is manufactured by the Penfield Shock Absorber Company, 49 Randolph avenue, Meriden, Conn.